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MSS. intended for publication and books, etc., intended for review should be sent to Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

THE PACIFIC COAST MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

IN its sixty-seventh year the American Association for the Advancement of Science reached the Pacific coast after wandering in previous years to all the principal cities of the east and central west of the United States and Canada, on one occasion venturing as far west as Denver. The California meeting is thus memorable in itself as marking an epoch in the history of our association as well as for its coincidence with the superb Panama-Pacific Exposition of the practical, educational and artistic development of the world.

It is not too much to say that this meeting of the association was an event of real importance in the scientific development of our country. While the exposition is in a measure a summary of the world's progress in the arts and applied sciences from the time when the great westward migration began from Asia some 25,000 or 30,000 years ago, our association meeting was very wisely planned throughout to bear chiefly a Pacific-coast and Pacific-ocean character. This field in itself is a very large one, and it was broadened by including the relations which the Pacific region in general bears to other parts of the world.

All of the members, and especially those who had not visited the Pacific coast before, arrived with a keen spirit of interest in the scientific wonders of the great state of California, its past history, the records which its very able men of science have established in every branch, the problems which confront the present generation, and

last but not least in the work of the body of talented young men and women who are now entering science from the two great universities and other educational institutions of the state. In no other region is the outlook for the advancement of science more encouraging.

The admirable handbook "Nature and Science on the Pacific Coast," written in collaboration by thirty-one specialists, was quite widely distributed prior to as well as at the meeting and thoroughly prepared the members of the association for the general understanding of the geography, the history, the geology and physiography, the climate, the past and present animal and plant life, the economic and educational development of California. The preparation of this booklet was a felicitous idea and it developed into a most tasteful and interesting volume under the chairmanship of Professor John C. Merriam. Similarly Director George Otis Smith of the United States Geological Survey prepared for the westward journey of members of the association by projecting a series of historic and geologic guidebooks of the western United States, one for each of the great transcontinental railway routes. The first of these volumes, which is entitled "Part B, The Overland Route with a Side Trip to Yellowstone Park," written by Messrs. Lee, Stone, Gale and others of the survey, furnished a guide along the Union and Southern Pacific Railways from Omaha west. These several volumes can not be too highly praised; beside affording a clear introduction to the scientific aspects of the country en route they contain a great deal of information of permanent value.

We do not recall any previous meeting of the association for which such prolonged, intelligent and self-sacrificing attention has been devoted to preparation, to the scientific programs and to the scientific excursions. The whole endeavor was worthy both of the memorable event which took the association to California and of the very high scientific standards which have been established in the state. This preparation also reflected the very cordial spirit of cooperation which now unites scientific men of all parts of the Pacific coast. Those of us from other states who were fortunate enough to be present at this admirably planned meeting can hardly find words to express our appreciation of the labors of the various committees, which were composed of many of the leading men and women of the Pacific coast states as well as of our eastern possessions in the Pacific, Hawaii and the Philippines.

Among the leaders during two years of almost unceasing preparation were the president of the association, Director W. W. Campbell of the Lick Observatory, who served as chairman of the executive committee as well as of the Pacific Coast committee, the latter committee including most of the prominent scientific men of the Pacific Coast states. Another very active member was Professor Merriam, paleontologist of the University of California, who ably cooperated with President Campbell for the general welfare of the association but especially in the arrangement of the programs of the Geological and Paleontological Societies. The newly elected president of Stanford University, Professor John C. Branner, served as the head of the committee on scientific program. Among the many ladies who took an active interest in the social features of the meeting may be mentioned Mrs. Phoebe Apperson Hearst, long a patroness of science on the Pacific coast, who took the title of honorary president of the general committee and gave a delightful afternoon reception at the Hacienda del Pozo de Verona near Pleasanton.

The scientific sessions were chiefly held in the University of California, the president and faculty uniting in cordial hospitality throughout the week. Half days and evenings were partly given to visits to the Exposition. The general evening reception in the California State Building was delightfully arranged. One of the very enjoyable features of the meeting was Stanford University Day, Wednesday, August sixth, during which Ex-president Jordan, President Branner and the faculty of the university acted as hosts at Palo Alto.

The excursions were admirably arranged, extending to every part of California, and it may be said that no other state is so crowded with scientific interest. In the presence of living volcanoes, living glaciers and great recent earthquakes one finds geologic history still being written. The state is absolutely unique also in many of the features of its present abounding animal and vegetable life, especially perhaps in its forest and desert floras, and is no less unique in many features of its coastal Pacific life.

The central subject of the natural history of California, of the Pacific coast, and of the Pacific ocean naturally dominated the meetings, especially those in geology, paleontology, seismology, botany, zoology and anthropology. Thus the programs of all of the sessions, which were throughout of exceptional interest, were chiefly devoted to what may be called the science of the coast, with a lesser amount of time assigned for general papers. For the public of San Francisco three evening public addresses, also on Pacific problems, were delivered by Professor Daly of Harvard, Professor Scott of Princeton and Professor Reinsch, U. S. Ambassador to China. The geologists and paleontologists united in a series of spirited discussions on the means of determining the time relations of great events in the past history of the state of California and events in other parts of the United States and the Old World. These two societies seldom have had more important programs or a more valuable series of contributions than those presented by the leading geologists of California and by the invited geologists and paleontologists from the east. Especially noteworthy was the contribution on the correlation of the Triassic by James Perrin Smith of Stanford University. The Astronomical Society also had a full and influential meeting in joint session with Section A of the association, concluding with enjoyable excursions to the Lick Observatory and to the Mt. Wilson Observatory near Pasadena.

Taken altogether the entire program proved to be very stimulating to all those who came from other sections of the country. The broad conception of the original purposes of the association, which distinguishes our sister associations of Great Britain and the continent, was manifest throughout and rendered the Pacific Coast meeting one of the most notable and memorable in our history.

HENRY FAIRFIELD OSBORN

PROCEEDINGS OF THE MEETING

THE opening session of the Pacific Coast meeting of the American Association for the Advancement of Science and of affiliated societies was held on Monday morning, August 2, in the Scottish Rite Auditorium, San Francisco. At this session the following addresses were given:

Address of welcome on behalf of the Panama-Pacific International Exposition, William Henry Crocker, first vice-president of the Panama-Pacific International Exposition.

Address of welcome on behalf of the Pacific Division of the American Association for the Advancement of Science, Benjamin Ide Wheeler, president of the University of California.

Address of welcome on behalf of the institutions of learning in the Pacific region, David Starr Jordan, chancellor of Leland Stanford Junior University.

Response to the addresses of welcome, Henry Fairfield Osborn, president of the American Museum of Natural History.

Announcements, L. O. Howard, permanent secretary of the American Association for the Advancement of Science.

Address: "Science and Civilization," William Wallace Campbell, president of the American Association for the Advancement of Science.

Other general meetings of the association, as a whole, included three public evening addresses which were presented in San Francisco, also in the Scottish Rite Auditorium:

Tuesday, August 3, "Problems of the Pacific Islands," Reginald Alsworth Daly, Harvard University.

Thursday, August 5, "The Isthmus of Panama and Its Influence on the Animal Life of North and South America," William Berryman Scott, Princeton University.

Friday, August 6, "The Economic Future of the Pacific," Paul Samuel Reinsch, American Ambassador to China.

On Monday evening, August 2, a reception was tendered to the visiting scientists in the California Building on the Exposition grounds, San Francisco. On Thursday afternoon, August 5, a garden fête was prepared for the visiting ladies and for the members of the Association and of affiliated societies in an oak grove on the campus of the University of California.

The sessions of sections and of societies on Wednesday, August 4, were held at Stanford University. Over 400 members and friends of the association and affiliated societies were taken by a special train from San Francisco to Palo Alto on this occasion. After a general session for addresses of welcome and of response, luncheon was served in Memorial Court, Stanford University. The afternoon was devoted to meetings of sections and of societies. The visiting ladies were entertained at a musicale in Memorial Church, and later in the afternoon at tea in the Women's Club House. On Wednesday evening upon the return from Stanford University, dinners of several sections and societies were held as follows:

Section A, Mathematics and Astronomy, the American Mathematical Society, and the American Astronomical Society; Hotel Oakland, Oakland.

Section B, Physics, and the American Physical Society; Jules Café, San Francisco.

The Geological Society of America, the Paleontological Society, and the Seismological Society; Engineers' Club, Mechanics Institute Building, San Francisco.

Biological Society of the Pacific, jointly with visiting biologists; Hotel Sutter, San Francisco.

Section H, Anthropology and Psychology, and the American Psychological Association; Castilian Café, San Francisco.

Section H, Anthropology and Psychology, and the American Anthropological Association; Hang Far Low Café, San Francisco.

Sessions of sections and of societies on other days of the week were held at the University of California, Berkeley.

During the latter days of the week and in the week succeeding, excursions were organized as follows:

For mathematicians and astronomers to the Lick Observatory at Mount Hamilton, including a visit to the home of Mrs. Phoebe Apperson Hearst near Pleasanton.

For geologists to Hunter's Point, San Francisco, for an examination of Franciscan formation; to Point Reyes Station, Marin County, for an examination of the San Andreas fault and rift; to Lassen Peak, Shasta County, to note the recent volcanic activity of that mountain; to Mount Diablo, Contra Costa County, to examine the series of strata composing the geosyncline between the Bay of San Francisco and Mount Diablo; and to the Yosemite Valley region.

For paleontologists to the shore of San Pablo Bay to examine localities for Cretaceous, Tertiary and Pleistocene faunas; to the Mount Diablo region; to the Ricardo Pliocene beds of the Mohave Desert; to the Pleistocene asphalt deposits of Rancho La Brea near Los Angeles; and to the marine Pleistocene deposits near San Pedro.

For zoologists and botanists to Muir Woods and Mount Tamalpais, and for botanists to the

Yosemite Valley and to the Monterey Peninsula and the Carnegie Desert Laboratory at Carmel.

The sections and societies meeting independently or in conjunction with these sections upon this occasion were as follows:

Section A, Mathematics and Astronomy.
Section B, Physics.
Section F, Zoology.
Section G, Botany.
Section H, Anthropology and Psychology.
Section L, Education.
Section M, Agriculture.
Astronomical Society of the Pacific.
American Astronomical Society.
American Mathematical Society.
American Physical Society.
Geological Society of America and the Cordilleran Section.
Paleontological Society.
Seismological Society of America.
American Society of Naturalists.
American Society of Zoologists.
Biological Society of the Pacific.
Entomological Society of America.
American Association of Economic Entomologists (August 9 and 10).
Pacific Slope Association of Economic Entomologists (August 9 and 10).
American Phytopathological Society.
American Fern Society.
American Psychological Association.
American Association for the Study of the Feeble-Minded.
American Anthropological Association.
Archeological Institute of America.
American Genetic Association.
Association of American Dairy, Food and Drug Officials.

Altogether over ninety sessions of the association, of sections and of other societies were held during this week of meetings.

The total registered attendance at these meetings of members of the association or of participating societies was 606. In addition to this registration the names were given of 174 ladies accompanying members of the societies. The attendance from states and from abroad was distributed as follows:

Arizona, 7
California, 300
Colorado, 4
Connecticut, 4
Delaware, 1
Florida, 1
Idaho, 5
Illinois, 9
Indiana, 2
Iowa, 6
Kansas, 8
Louisiana, 4
Maine, 1
Maryland, 5
Massachusetts, 12
Michigan, 1
Minnesota, 9
Mississippi, 1
Missouri, 13
Montana, 4
Nebraska, 8
Nevada, 10
New Hampshire, 1
New Jersey, 5
New Mexico, 3
New York, 24
North Dakota, 2
Ohio, 9
Oklahoma, 1
Oregon, 25
Pennsylvania, 8
Rhode Island, 1
South Carolina, 1
South Dakota, 1
Tennessee, 1
Texas, 8
Utah, 9
Vermont, 1
Virginia, 1
Washington, 19
Washington, D. C., 31
West Virginia, 2
Wisconsin, 3
Wyoming, 2
Canada, 7
China, 1
Cuba, 1
Denmark, 1
England, 3
Hawaiian Islands, 8
Japan, 4
Mexico, 2
New Zealand, 1
Philippine Islands, 3
Sweden, 1
Syria, 1

ALBERT L. BARROWS,
Secretary, Pacific Division

FARMING AND FOOD SUPPLIES IN TIME OF WAR[1]

AGRICULTURE is the antithesis of warfare; farming is preeminently a peaceful avocation, and farmers are essentially men of peace. The husbandman is not easily disturbed by war's alarms, and his intimate association with the placid and inevitable processes of nature engenders a calmness of spirit which is unshaken by catastrophe. Many stories illustrative of this attitude of mind come to us from the battlefields. The complete detachment of the fighting men from the rest of the community which was usual up to quite recent times is impossible in these days when in almost every country the army is not a class but the nation. It is inconceivable now that a war could rage of which it could be said, as has been said of our civil war:

> Excepting those who were directly engaged in the struggle, men seemed to follow their ordinary

[1] Address of the president to the Agricultural Section of the British Association for the Advancement of Science, Manchester, 1915.

business and their accustomed pursuits. The story that a crowd of country gentlemen followed the hounds across Marston Moor, between the two armies drawn up in hostile array, may not be true; but it illustrates the temper of a large proportion of the inhabitants.[2]

But, while farmers and peasants within the range of the guns can not now ignore the fighting, they have repeatedly demonstrated their invincible determination that the madness of mankind shall not interrupt the calm sanity of the ordered cultivation of the soil. Of a district in the Argonne, a correspondent, writing in April last, said:

> The spring seed has already been sown or is being sown, sometimes indifferently, under shell-fire, right up to the edge of the trenches.[3]

A story was told of a farmer in Flanders looking over the parapet of a trench and demanding of an indignant British officer whether any of his men had stolen his pig. On receiving a suitable reply, he observed that he had already asked the French, who also denied all knowledge of the missing animal, so that he supposed it must be those condemned Germans, whom he forthwith proceeded to interview. Such a sublime sense of values, such absorption in the things that matter, such contempt for the senseless proceedings of warfare, are only possible to the agriculturist. The quarrels of mankind are transient, the processes of nature are eternal. One thinks of Matthew Arnold's lines:

> The East bowed low before the blast
> In patient deep disdain;
> She let the legions thunder past,
> And plunged in thought again.

But, while the farmer is by instinct a pacifist, he is also, in a cause which rouses him, a doughty fighter. In that same civil war to which so many were indifferent, the farmers of East Anglia, under Cromwell, changed the course of English history; and the thoroughness with which they turned their ploughshares into swords is demonstrated by the fact that when they took to soldiering they put the nation for the first and only time under what is now termed militarism; that is, government controlled by the army. In the last battle fought on English soil the yeomen and peasants of the West Country proved, amid the butchery of Sedgemoor, that bucolic lethargy can be roused to desperate courage. Indeed, through all our island story, since the English yeomen first broke the power of medieval chivalry and established the supremacy of infantry in modern warfare, it has been from the rural districts that the nation has drawn its military strength. Even in the present war, when the armies of the empire have been drawn from all classes of the community, the old county regiments and the yeomanry squadrons with their roots in the countryside have proved once more that the peaceful rustic is as undismayed on the field of battle as on the fields of peace.

It is, however, in his pacific rather than in his belligerent aspect that the British farmer now claims our attention, and, before considering the position of farming in the present war, we may briefly glance at its position when a century ago the nation was similarly engaged in a vital struggle.

From February 1793 until 1815, with two brief intervals, we were at war, and the conflict embraced not only practically all Europe but America as well. The latter half of the eighteenth century had witnessed a revolution of British agriculture. The work of Jethro Tull, "Turnip" Townshend, Robert Bakewell, and their disciples, had established the principles of modern farming. Coke of Holkham had begun his missionary work; Arthur Young was preaching the gospel of progress; and in 1803 Humphry Davy delivered his epoch-ma-

[2] Prothero, "English Farming, Past and Present," p. 104.

[3] *Westminster Gazette*, April 30, 1915.

king lectures on agricultural chemistry. Common-field cultivation, with all its hindrances to progress, was rapidly being extinguished, accelerated by the General Inclosure Act of 1801. A general idea of the state of agriculture may be obtained from the estimates made by W. T. Comber of the area in England and Wales under different crops in 1808. There were then no official returns, which, indeed, were not started until 1866; but these estimates have been generally accepted as approximately accurate and are at any rate the nearest approach we have to definite information.

I give for comparison the figures from the agricultural returns of 1914, which approximately correspond to those of the earlier date:

	1808 Acres	1914 Acres
Wheat	3,160,000	1,807,498
Barley and rye	861,000	1,558,670
Oats and beans	2,872,000	2,223,642
Clover, rye-grass, etc.	1,149,000	2,558,735
Roots and cabbages cultivated by the plough	1,150,000	2,077,487
Fallow	2,297,000	340,737
Hop grounds	36,000	36,661
Land depastured by cattle	17,479,000	16,115,750

The returns in 1914 comprise a larger variety of crops than were cultivated in 1808. Potatoes, for instance, were then only just beginning to be grown as a field-crop, and I have included them together with Kohl-rabi and rape, among "roots and cabbages."

The population of England and Wales in 1801 was 8,892,536, so that there were 35½ acres under wheat for every hundred inhabitants. In 1914 the population was 37,302,983, and for every hundred inhabitants there were 5 acres under wheat.

The yield of wheat during the twenty years ending 1795 was estimated at 3 qrs. per acre;[4] in 1914 it was 4 qrs. per acre. The quantity of home-grown wheat per head of population was therefore 8½ bushels in 1808, and 1½ bushels in 1914. Nevertheless, even at that time, the country was not self-supporting in breadstuffs. In 1810, 1,305,000 qrs. of wheat and 473,000 cwt. of flour were imported. The average annual imports of wheat from 1801 to 1810 were 601,000 qrs., and from 1811 to 1820 458,000 qrs. Up to the last decade of the eighteenth century England was an exporting rather than an importing country, and bounties on exports were offered when prices were low, from 1689 to 1814, though none were, in fact, paid after 1792.

During the war period we are considering, the annual average price of wheat ranged from 49 s 3 d per qr. in 1793 to 126 s 6 d per qr. in 1812; the real price in the latter year, owing to the depreciation of the currency, being not more than 100 s. In 1814 the nominal price was 74 s 4 d and the real price not more than 54 s per qr.[5] The extent to which these high and widely varying prices were affected by the European war has been the subject of controversy. As we mainly depended on the Continent for any addition to our own resources, the diminished production during the earlier years in the Netherlands, Germany and Italy, and in the later years of the war in Russia, Poland, Prussia, Saxony and the Peninsula, reduced possible supplies. At the same time the rates of freight and insurance, especially in the later years of the war, increased very considerably. Tooke mentions a freight of £30 per ton on hemp from St. Petersburg in 1809. On the other hand, a powerful impetus was given

[4] Report of Select Committee on the means of promoting the cultivation and improvement of the waste, uninclosed and unproductive lands of the kingdom, 1795.

[5] Porter's "Progress of the Nation," by F. W. Hirst, p. 183.

to home production, which was stimulated by government action and private enterprise. Inclosure was encouraged by the General Inclosure Act of 1801, and 1,934 Inclosure Acts were passed from 1793 to 1815. The schemes for increasing and conserving food supplies were various. The Board of Agriculture, for example, offered prizes of 50, 30 and 20 guineas, respectively, to the persons who in the spring of 1805 cultivated the greatest number of acres—not less than 20—of spring wheat.[6] In 1795 a Select Committee recommended that bounties should be granted to encourage the cultivation of potatoes on "lands at present lying waste, uncultivated, or unproductive," and that means should at once be adopted to add at least 150,000 and perhaps 300,000 acres to the land under cultivation "as the only effectual means of preventing that importation of corn, and disadvantages therefrom, by which this country has already so deeply suffered." Another view of importation is presented by Tooke, who, in a discussion of the effect of the war, says:

> Although the war can not have been said to have operated upon the supply of agricultural produce of our own growth and other native commodities, sufficiently to outweigh the circumstances favorable to reproduction, it operated most powerfully in increasing the cost of production and in obstructing the supply of such commodities as we stood in need of from abroad. It is therefore to war chiefly as affecting the cost of production and diminishing the supply, by obstructions to importation, at a time when by a succession of unfavorable seasons our own produce became inadequate to the average consumption, that any considerable proportion of the range of high prices is to be attributed.[7]

The main cause of high prices and scarcity was the failure of the harvests. Mr. Prothero thus analyses the wheat harvests of the twenty-two years 1793–1814:

> Fourteen were deficient; in seven out of the fourteen the crops failed to a remarkable extent, namely in 1795, 1799, 1800, 1809, 1810, 1811, 1812. Six produced an average yield. Only two, 1796 and 1813, were abundant; but the latter was long regarded as the best within living memory.[8]

It appears paradoxical, but in a sense it is true, to say that the scarcity of wheat in certain years arose from the fact that the country was too largely dependent on its own crop. The risk of a bad harvest in a climate such as that of the British Isles must always be serious, and by the fortune of war this risk between 1793 and 1814 turned out to be very high. When supplies are drawn from the four quarters of the globe, it is evident that the risk of a shortage in time of peace is greatly reduced. Whether in a great war it is preferable to be more dependent on the sea than on the season is debatable.

In comparison with wars for national existence, such as that against Napoleon and in a still sterner sense that in which we are now engaged, other conflicts appear insignificant. The Crimean War, however, did affect our food supplies and had a reflex action on British agriculture. The cessation of imports from Russia caused a rise in the price of corn. The average price of wheat rose to 72s 5d per qr. in 1854, 74s 8d in 1855 and 69s 2d in 1856. Only once before (in 1839) during the previous thirty-five years had it risen above 70s. There were then no agricultural returns, but the estimates of Lawes, which were generally accepted, put the area under wheat at a little more than 4,000,000 acres, a higher figure than has been suggested for any other period. It is, indeed, highly probable that the Crimean War marked the maximum of wheat cultivation in this coun-

[6] "Annals of Agriculture," 1805.

[7] "History of Prices," ed. 1838, Vol. I., p. 116.

[8] "English Farming, Past and Present," p. 269.

try. It was a time of great agricultural activity and of rapid progress. To their astonishment, farmers had found, after an interval of panic, that the repeal of the corn laws had not obliterated British agriculture and that even the price of wheat was not invariably lower than it had often been before 1846. Caird had preached "high farming" in 1848 and found many disciples, capital was poured into the land, and the high prices of the Crimean period stimulated enterprise and restored confidence in agriculture.

To generalize very roughly, it may be said that while the Napoleonic wars were followed by the deepest depression in agriculture, the Crimean War was followed by a heyday of agricultural prosperity which lasted for over twenty years. What the agricultural sequel to the present war may be, I leave to others to estimate, and I turn to consider briefly some of its effects on British farming up to the present time.

Harvest had just begun when war broke out on August 4; indeed, in the earlier districts a good deal of corn was already cut. The harvest of 1914 was, in fact, with the exception of that of 1911, the earliest of recent years, as it was also one of the most quickly gathered. The agricultural situation may perhaps be concisely shown by giving the returns of the crops then in hand, *i. e.*, in course of gathering or in the ground, with the numbers of live stock as returned on farms in the previous June. The figures are for the United Kingdom, and I add the average for the preceding ten years for comparison:

	1914	Average 1904–13
	Qrs.	Qrs.
Wheat	7,804,000	7,094,000
Barley	8,066,000	7,965,000
Oats	20,664,000	21,564,000
Beans	1,120,000	1,059,000
Peas	374,000	525,000
	Tons	Tons
Potatoes	7,476,000	6,592,000
Turnips and swedes	24,196,000	26,901,000
Mangold	9,522,000	9,934,000
Hay	12,403,000	14,148,000
	Cwts.	Cwts.
Hops	507,000	354,000
	No.	No.
Cattle	12,185,000	11,756,000
Sheep	27,964,000	29,882,000
Pigs	3,953,000	3,805,000
Horses	1,851,000	2,059,000

Farmers had thus rather more than their usual supplies of nearly every crop, the chief deficiencies being in peas, roots and hay. The shortage of the hay-crop was, however, in some measure made up by the large stocks left from the unusually heavy crop of 1913. It was fortunate from the food-supply point of view that two of the most plentiful crops were wheat and potatoes. The head of cattle was very satisfactory, being the largest on record, and pigs were well above average. Sheep, always apt to fluctuate in numbers, were much below average, the total being the smallest since 1882 with the exception of 1913.

On the whole, it was a good year agriculturally, and the supply of home-grown produce at the beginning of the war was bountiful. Nature at any rate had provided for us more generously than we had a right to expect.

At first it appeared as if farmers were likely to be sufferers rather than gainers by the war. Prices of feeding-stuffs, especially linseed and cotton-cakes, maize-meal, rice-meal and barley-meal, rose at once, recruiting affected the labor supply, and difficulties arose in the distribution of produce by rail. With one or two exceptions, such as oats, the prices of farm produce showed but little rise for three or four months after the war began. Wheat rose about 10 per cent., barley remained about normal, cattle

by November had not risen more than 3 per cent., sheep and veal-calves showed no rise until December, while poultry was actually cheaper than usual, though eggs rose considerably. Butter rose slightly, and cheese remained about normal. Up to nearly the end of the year, in fact, it may be said generally that British farm-produce made very little more money than usual.

Meanwhile the nation began to take a keen interest in the agricultural resources of the country, and farming became the object of general solicitude. We started with great energy to improvise, in truly British fashion, the means of facing the supreme crisis of our fate, but the elementary fact at once became obvious that it is impossible to improvise food. The main farm-crops take an unreasonably long time to grow, even if the land is prepared for them, and a sudden extension of the area under cultivation is not a simple proposition. It was freely pointed out—with undeniable truth—that our agricultural system had not been arranged to meet the conditions of a great European war, and many suggestions were made to meet the emergency. Some of these suggestions involved intervention by legislative or administrative action. It was decided that any attempt violently to divert the course of farming from its normal channels would probably not result in an increased total production from the land. The agricultural consultative committee, appointed by the president of the board of agriculture on August 10, issued some excellent advice to farmers as to their general line of policy and the best means by which they could serve the nation, and this was supplemented by the board and by the agricultural colleges and local organizations throughout the country. No less than thirty special leaflets were issued by the board, but, while it may, I think, fairly be claimed that all the recommendations made officially were sound and reasonable, I should be the last to aver that farmers were universally guided by them. They do not accept official action effusively:

> Unkempt about those hedges blows
> An English unofficial rose,

and official plants do not flourish naturally in farm hedgerows. It was, however, fairly evident that patriotism would suggest an effort to obtain the maximum production from the land, and there were good reasons to think that self-interest would indicate the same course. It must be admitted, however, that during the autumn the lure of self-interest was not very apparent. Food-prices, however, at the end of the year began to rise rapidly. English wheat in December was 25 per cent. above the July level, in January 45 per cent., in February and March 60 per cent., and in May 80 per cent. Imported wheat generally rose to a still greater extent, prices in May standing for No. 2 North Manitoba 95 per cent., and No. 2 Hard Winter 90 per cent. above July level. The greater rise in imported wheat may be noted as vindicating farmers against the charge which was made against them of unreasonably withholding their wheat from the market. Cattle and sheep rose more slowly, but in March prices of both had risen by 20 per cent., and in May and June cattle had risen by about 40 per cent. Butter rose by about 20 per cent. and cheese by about 40 per cent. Milk rose little through the winter, but when summer contracts were made prices remained generally at the winter level.

British agriculture, like the British Isles, is a comparatively small affair geographically. The 47 million acres which it occupies, compared with the 80 million acres of Germany or the 90 million acres of France, and still more with the 290 million acres of the United States, represent an

area which may be termed manageable and about which one might expect to generalize without much difficulty. But, in fact, generalization is impossible. Even on the 27 million acres of farm land in England and Wales there is probably more diversity to the square mile than in any country on earth. The variations in local conditions, class of farming, and status of occupier preclude the possibility of making any general statement without elaborate qualifications. Thus whatever one might say as to the effects of the war on agriculture would be certain to be inaccurate in some districts and as regards some farmers.

There are three main agricultural groups, corn-growing, grazing and dairying. They overlap and intermingle indefinitely, and there are other important groups, such as fruit-growing, vegetable-growing, hop-growing, etc., which represent a very large share of the enterprise and capital engaged on the land. The receipts of the corn-growing farmer generally speaking were substantially increased. Probably about 50 per cent. of the wheat-crop had been sold before prices rose above 40s per quarter, and there was very little left on the farms when they reached their maximum in May. Oats rose rather more quickly, but did not reach so high a level, relatively, as wheat. Barley—owing perhaps to enforced and voluntary temperance—never made exceptional prices, and in fact the best malting barleys were of rather less than average value. There is no doubt, however, that farmers who depended mainly on corn-growing found an exceptionally good market for their crops and made substantial profits. Farmers who depended mainly on stock were less generally fortunate, although stock were at a fairly high level of price when the war began. Sheep for some time showed no signs of getting dearer, but in the spring prices rose substantially, and a good demand for wool—which in one or two cases touched 2s per lb.—made the flockmasters' returns on the whole very satisfactory. Cattle followed much the same course; stores were dear, but by the time fat stock came out of the yards or off the grass prices had risen to a very remunerative level. The large demands on imported supplies of meat for the British and French armies occasioned a distinct shortage for the civil population, but this was relieved by a reduced demand, so that the effect upon prices of native beef and mutton was not so great as might have been expected. The influence of a rise of price upon demand is more marked in the case of meat than in that of bread. While there has been a distinct reduction in the consumption of meat, there is no evidence of a reduced consumption of bread.

Dairy farmers generally found themselves in difficulties. Prices of butter and cheese increased but slightly, and milk remained for a considerable period almost unchanged. The rise in the prices of feeding-stuffs and the loss of milkers aggravated their troubles. An actual instance of the position in February as affecting a fairly typical two-hundred acre farm may be quoted. It had thirty milch cows producing about 16,500 gallons per annum. The cake bill showed an advance of fifty per cent., and wages had risen twelve per cent. It was calculated that the extra cost was 1.3d per gallon of milk. Later the prices of milk, butter and cheese rose, but on the whole it can not be said that dairy farmers generally made exceptional profits.

While it is certain that the gross receipts by farmers were substantially increased, it is very difficult to estimate what the net pecuniary gain to agriculture has been. It can only be said generally that while some have made substantial profits, which were probably in very few cases excessive, many others have

on balance (after allowing for extra cost) done no better financially, and some perhaps even worse, than in an average year of peace. With regard to one item of extra cost, that of labor, it is possible to make an approximate estimate. Agricultural laborers were among the first to respond to the call for the new armies, and, up to the end of January, fifteen per cent. had joined the forces of the Crown. This considerable depletion of labor was not acutely felt by farmers during the winter, but during the spring and summer serious difficulty was experienced and many devices were suggested—some of which were adopted—for meeting it. Naturally the wages of those agricultural laborers who were left rose, the rise varying in different districts but being generally from 1s 6d to 3s per week. Owing to the rise in the price of commodities, this increase of wages can not be regarded as a profit to the laborers, but it is, of course, an outlay by farmers, which in England and Wales may be reckoned as amounting to an aggregate of about £2,000,000.

This country has never suffered from a dearth of agricultural advisers, and in such a time as the present, when every one is anxious to help the country, it is natural that they should be unusually plentiful. Advice was freely offered both to the government how to deal with farmers and to farmers how to deal with the land. Whether in consequence of advice or in spite of it, it may fairly be said that farmers throughout the United Kingdom have done their duty. They have met their difficulties doggedly and have shown an appreciation of the situation which does credit to their intelligence. It was not easy last autumn when farmers had to lay their plans for the agricultural year to forecast the future. We were all optimists then, and many thought that the war might be over before the crops then being planted were reaped. It was clear, however, that the national interest lay in maintaining and, so far as possible, increasing the produce of the land. In the quiet, determined way which is characteristic of them, farmers devoted themselves to the task, and the returns recently issued give the measure of their achievement. They have added twenty-five per cent. to the acreage of wheat and seven per cent. to the acreage of oats, and they have kept the area of potatoes up to the high and sufficient level of the previous year. These are the three most important crops. They have also not only increased the stock of cattle, which was already the largest on record, but, in spite of unfavorable conditions and a bad lambing season, they have increased the stock of sheep. In view of these facts, I venture to say that British and Irish farmers have shown both patriotism and intelligence, and may fairly claim to have contributed their share to the national effort.

The share of British agriculture in the food supply of the nation is more considerable than is sometimes realized. When I last had the honor to address the British association I ventured to emphasize this point, and I may be allowed to repeat, in a somewhat different form and for a later period, the figures then given. Taking those articles of food which are more or less produced at home, the respective proportions contributed by the United Kingdom, the rest of the Empire, and foreign countries were on the average of the five years 1910–14 as given in the table.

The war has directly affected some of our food supplies by interposing barriers against the exports of certain countries. Fortunately we were in no way dependent for any of these foods upon our enemies, though Germany was one of our main sources of supply for sugar. We received

	United Kingdom, Per Cent.	British Empire Overseas, Per Cent.	Foreign Countries, Per Cent.
Wheat	19.0	39.3	41.7
Meat	57.9	10.7	31.4
Poultry	82.7	0.2	17.1
Eggs	67.6	0.1	32.3
Butter (including margarine)	25.1	13.3	61.6
Cheese	19.5	65.4	15.1
Milk (including cream)	95.4	0.0	4.6
Fruit	36.3	8.0	55.4
Vegetables	91.8	1.1	7.1

some small quantities of wheat or flour and of eggs from Germany, Hungary and Turkey, some poultry from Austria-Hungary, and some fruit from Germany and Turkey, but the whole amount was insignificant. The practical cessation of supplies from Russia was the most serious loss, as we drew from thence on an average 9 per cent. of our wheat, 9 per cent. of our butter and 16 per cent. of our eggs.

The rather humiliating panic which took possession during the first few days of the war of a certain section of the population, who rushed to accumulate stores of provisions, arose not only from selfishness but from insufficient appreciation of the main facts about food supplies. Our large imports of food are constantly dinned into the ears of the people, but the extent and possibilities of our native resources are practically unknown. It is very natural, therefore, that the man in the street should assume that even a temporary interruption of oversea supplies would bring us face to face with famine.

Within the first few days of the war, the government, through the board of agriculture, obtained returns not only of the stocks of all kinds of food-stuffs in the country but also of the stocks of feeding-stuffs for animals and of fertilizers for the land. Powers were taken under the articles of commerce (returns, etc.) act to compel holders of stocks to make returns, but it is due to the trading community to say that in only two instances, so far as the board of agriculture was concerned, was it necessary to have recourse to compulsion. The returns of stocks of food-stuffs, feeding-stuffs and fertilizers have been made regularly to the board of agriculture[9] every month since the outbreak of war, and the loyal cooperation of the traders concerned deserves cordial recognition by those whose official duty has been rendered comparatively easy by their assistance. I may be allowed to add that the readiness with which traders communicated information which was, of course, of a very confidential nature, displayed a confidence in government departments which they may regard with some satisfaction.

A very casual glance at the national dietary suffices to show that John Bull is an omnivorous feeder, and as the whole world has eagerly catered for his table his demands are exigent. But, for various reasons, our daily bread, reluctant though most of us would be to be restricted to it, is regarded as the measure and index of our food supplies. On the 4th of August the board of agriculture published an announcement that they estimated the wheat-crop then on the verge of harvest at 7,000,000 quarters, and that, including other stocks in hand, there was at that time sufficient wheat in the country to feed the whole population for four months; and a few days later, having then obtained further information from about 160 of the principal millers, they stated that the supplies in the country were sufficient for five months' consumption. The board also announced, on August 5, that the potato crop would furnish a full supply for a whole

[9] Returns in Scotland and Ireland are made to the Agricultural Departments of those countries and the results transmitted to the Board of Agriculture and Fisheries.

year's consumption without the necessity for any addition from imports. When it was further announced that the government had taken steps to ensure against a shortage of sugar it began to be generally realized that at any rate the country was not in imminent danger of starvation. Indeed, on a broad survey of the whole situation, it was apparent that our native resources, together with the accumulated stocks of various commodities held in granaries, warehouses and cold stores, would enable the United Kingdom to face even the unimaginable contingency of a complete blockade of all its ports for a considerable period.

Nevertheless it was abundantly evident, not only to the man in the street, but even to those whose duty it was to consider such matters, that the maintenance of regular supplies was essential to avoid undue depletion of stocks. The risk that a certain number of vessels carrying food to this country might be sunk by the enemy was obvious, and it was at first very difficult to measure it. After a year of strenuous endeavor by the enemy it is satisfactory to record that, although a few cargoes of food-stuffs have been sunk, the effect on supplies has been practically negligible.

Under these circumstances it appeared that, provided adequate protection were given against unusual risks, commercial enterprise might in the main be relied upon to supply the demands of the people in the normal manner and in the usual course of business. It is a self-evident axiom that it is better not to interfere in business matters unless there is a paramount necessity for interference.

The machinery of modern business in a highly organized community is very complicated; the innumerable cog-wheels are hidden while the machine is running normally, but every single one of these becomes very obvious when you attempt to introduce a crowbar. With one or two exceptions the purveyors of food to the nation were left to conduct their business without official interference, though the board of trade took steps to ascertain what were the retail prices justified by the wholesale conditions and to disseminate the information for the protection of consumers against unreasonable charges.

One measure of a drastic and widespread nature was adopted. The exportation of a large number of commodities was prohibited. This was done for two reasons: (1) to conserve stocks in this country, and (2) to prevent goods from reaching the enemy. The latter object could be attained only very partially by this method so long as any sources of supply other than the ports of the United Kingdom were open to the enemy or to adjoining neutral countries. The former object—with which we are now only concerned—was on the whole achieved. The board of agriculture, concerned for the maintenance of our flocks and herds, at once secured a general prohibition of the exportation of all kinds of feeding-stuffs for animals. Many kinds of food-stuffs were at once included and later additions were made, so that for a long time past nearly all kinds of food have been included, though in some cases the prohibition does not apply to the British Empire or to our Allies. The exportation of fertilizers, agricultural seeds, binder twine and certain other commodities more or less directly connected with the conservation of our food supplies, was also prohibited, so that generally it may be said that the outlet for any food in the country was under effective control. This is not the time or place to discuss the reasons why in some instances limited quantities of certain articles were allowed to escape under license. It is only necessary to remark that in all such cases

there were cogent reasons in the national interest for the action taken.

Direct government intervention in regard to food supplies was limited to three commodities—sugar, meat and wheat. In the case of sugar the whole business of supply was taken over by the government—a huge undertaking but administratively a comparatively simple one, owing to the fact that there are no home-grown supplies. Intervention in the meat trade was necessitated by the fact that the enormous demands of the allied armies had to be met by drafts upon one particular kind of meat and mainly from one particular source. The board of trade cooperated with the war office, and a scheme was evolved whereby a very large part of the output of meat from South America and Australia comes under government control.

As regards wheat, the intervention of the government took two forms. The scheme whereby the importation of wheat from India was undertaken by the British government, in cooperation with the Indian government, arose primarily from conditions in India rather than from conditions in the United Kingdom, although it is hoped and believed that the results will prove to be mutually advantageous. Other than this the intervention of the government in regard to wheat was devised as an insurance against the risk of interruption of normal supplies, its main object being to prevent the stocks of wheat in the country from falling to a dangerous level at a time when the home crop would be practically exhausted. When the home crop is just harvested there are ample reserves in the country for some months, and, as the United States and Canada are at the same time selling freely, stocks held by the trade are usually high. While home-grown wheat remains on the farms it is practically an additional reserve supplementary to the commercial reserves. When it leaves the farmers' hands, even although it may not actually go into consumption, it becomes part of the commercial reserve. This reserve in the nature of business tends to be constant, but fluctuates within rather wide limits under the influence of market conditions. If the price of wheat rises substantially and the capital represented by a given quantity increases, there is a natural tendency to reduce stocks. If also there is any indication of a falling market ahead, whether from favorable crop prospects or the release of supplies now held off the market for any reason, a prudent trader reduces his stocks to the smallest quantity on which he can keep his business running. So long as shipments reach this country, as in normal times they do, with, as a member of the Baltic once expressed it to me, "the regularity of buses running down Cheapside," the country may safely rely on receiving its daily bread automatically. But if any interruption occurred at a time when the trade, for the reasons just indicated, happened to be running on low stocks, the margin for contingencies might be insufficient. I am, of course, debarred from discussing the method adopted or the manner in which the scheme was carried out, but, as the cereal year for which it was devised is over, it is permissible to state that the object in view was successfully achieved.

Of the 47,000,000 people who form the population of the United Kingdom the large majority are absolutely dependent for their daily food on the organization and regular distribution of supplies. The countryman, even if he possesses no more than a pig and a garden, might exist for a short time, but the town-dweller would speedily starve if the organization of supplies broke down. He does not, perhaps, sufficiently realize the intricacy of the commercial arrangements which make up that organiza-

tion, or the obstacles which arise when the whole economic basis of the community is disturbed by a cataclysm such as that which came upon us thirteen months ago. The sorry catchword "business as usual" must have sounded very ironically in the ears of many business men confronted with unforeseen and unprecedented difficulties on every side. The indomitable spirit with which they were met, the energy and determination with which they were overcome, afford further evidence of that which has been so gloriously demonstrated on land and sea, that the traditional courage and grit of the British race have not been lost.

To the question how have our oversea food supplies been maintained during the first year of the war, the best answer can be given in figures.

Imports of the principal kinds of food during the first eleven months of the war were as under, the figures for the corresponding period of 1913–14 being shown for comparison:

	1914–15, Thousands of Cwts.	1913–14, Thousands of Cwts.	Increase + or Decrease − Per Cent.
Wheat (including flour)	113,797	113,398	− 1.39
Meat	15,868	18,026	−11.97
Bacon and hams	7,452	5,975	+24.72
Cheese	2,766	2,386	+15.93
Butter (including margarine)	5,376	5,748	− 6.47
Fruit	18,830	17,512	+ 7.53
Rice	9,573	4,840	+97.79
Sugar	35,029	38,356	− 8.67

In total weight of these food-stuffs, the quantity brought to our shores was rather larger in time of war than in time of peace. Yet one still occasionally meets a purblind pessimist who plaintively asks what the navy is doing. This is a part of the answer. It is also a measure of the success of the much-advertised German "blockade" for the starvation of England. So absolute a triumph of sea-power in the first year of war would have been treated as a wild dream by the most confirmed optimist two years ago. The debt which the nation owes to our sailor-men is already immeasurable. That before the enemy is crushed the debt will be increased we may be assured. The crisis of our fate has not yet passed, and we may be called upon to meet worse trials than have yet befallen us. But in the navy is our sure and certain hope.

> That which they have done is but earnest of the things that they shall do.

Under the protection of that silent shield the land may yield its increase untrodden by the invading foot, the trader may pursue his business undismayed by the threats of a thwarted foe, and the nation may rely that, while common prudence enjoins strict economy in husbanding our resources, sufficient supplies of food will be forthcoming for all the reasonable needs of the people.

R. H. Rew

THE MANCHESTER MEETING OF THE BRITISH ASSOCIATION

In an account of the meeting *Nature* states that the number of members and associates (1,438), although satisfactory in the circumstances, was small as compared with previous meetings. But it is said that the section rooms were well filled both in the morning and afternoon sittings, and the proceedings were of exceptional interest.

The reception by the Lord Mayor in the School of Technology on Wednesday evening was the only general social function of the week, but being fixed on the second day of the meeting it gave a welcome opportunity to members to meet their friends as well as to inspect the machinery, appliances and lecture-rooms with which this great institution is equipped. The arrangements made by the committee for the visits of members to factories, warehouses, municipal undertakings and various places of special interest in Manchester and district worked well, and the short excursions were well attended. The citizen's lectures given in Manchester and other towns

in the neighborhood attracted large audiences. The subjects dealt with were: "Evolution and War," by Professor F. W. Gamble; "The Strategic Geography of the War," by Dr. Vaughan Cornish; "The Making of a Big Gun," by Dr. W. Rosenhain; "Daily Uses of Astronomy," by Mr. A. R. Hinks; "Health Conditions in the Modern Workshop," by Professor B. Moore; "Formation of the Sun and Stars," by the Rev. A. L. Cortie; "Some Lessons from Astronomy," by Professor H. H. Turner; and on "Curiosities and Defects of Sight," by Dr. W. Stirling, professor of physiology in the University of Manchester.

Grants of money appropriated for scientific purposes on behalf of the general committee are given below. The names of members entitled to call on the general treasurer for grants are prefixed to the respective committees. Of the forty-one committees receiving grants, only five are new.

SECTION A—MATHEMATICAL AND PHYSICAL SCIENCE

	£
Professor H. H. Turner—Seismological observations	130
Sir W. Ramsay—Tables of constants	40
Professor M. J. M. Hill—Mathematical tables.	35

SECTION B—CHEMISTRY

Professor H. E. Armstrong—Dynamic isomerism	20
Professor F. S. Kipping—Aromatic nitroamines	10
Mr. A. D. Hall—Plant enzymes	10
Professor H. E. Armstrong—Solubility phenomena	5
Professor H. E. Armstrong—Eucalypts	30
Professor Orme Masson—Influence of weather conditions on nitrogen acids in rainfall and atmosphere	20
Professor W. J. Pope—Crystalline form and molecular structure	10
Dr. F. D. Chattaway—Non-aromatic diazonium salts	8
Sir J. J. Dobbie—Absorption spectra, etc.	10

SECTION C—GEOLOGY

Professor Grenville Cole—Old red sandstone rocks of Kiltorcan	7
Professor W. W. Watts—Critical sections in Paleozoic rocks	20
Professor P. F. Kendall—List of characteristic fossils	10
Dr. J. Horne—Old red sandstone rocks at Rhynie	25
Dr. R. Kidston—Lower Carboniferous flora at Gullane	8

SECTION D—ZOOLOGY

Dr. A. E. Shipley—Belmullet Whaling Station.	25

SECTION E—GEOGRAPHY

Sir C. P. Lucas—Conditions determining selection of sites and names for towns	15

SECTION F—ECONOMIC SCIENCE AND STATISTICS

Professor J. H. Muirhead—Fatigue from economic standpoint	40
Professor W. R. Scott—Industrial unrest	20
Professor W. R. Scott—Women in industry	90
Professor W. R. Scott—Effects of war on credit, etc.	25

SECTION G—ENGINEERING

Professor J. Perry—Complex stress distributions	40
Dr. Dugald Clerk—Gaseous explosions	50
Dr. H. S. Hele-Shaw—Engineering problems affecting prosperity of the country	10

SECTION H—ANTHROPOLOGY

Sir C. H. Read—Age of stone circles	25
Professor G. Elliot Smith—Physical characters of ancient Egyptians	15
Dr. R. R. Marett—Paleolithic site in Jersey	25
Professor J. L. Myres—Archeological investigations in Malta	10
Professor J. L. Myres—Distribution of Bronze age implements	5

SECTION I—PHYSIOLOGY

Sir E. Schäfer—Ductless glands	20
Professor C. S. Sherrington—Mammalian heart.	20

SECTION K—BOTANY

Professor F. O. Bower—Cinchona Station, Jamaica	12
Professor F. W. Oliver—Structure of fossil plants	2
Professor F. F. Blackman—Heredity	45

SECTION L—EDUCATION

Professor J. A. Green—Museums	15
Dr. G. A. Auden—School books and eye-sight.	5
Dr. C. S. Myers—Mental and physical factors.	20

Mr. C. A. Buckmaster—"Free-place" system. 10

CORRESPONDING SOCIETIES COMMITTEE

Mr. W. Whitaker—For preparation of report. 25

Total £968

SCIENTIFIC NOTES AND NEWS

Dr. Edmund B. Wilson, Da Costa professor of zoology, gave the annual address at the opening exercises of Columbia University on September 29, his subject being "Science and Education."

Dean Frederick J. Wulling, of the College of Pharmacy of the University of Minnesota, was chosen president of the American Pharmaceutical Association, which held a session in San Francisco in August.

Dr. Theobold Smith, director, and other members of the staff of the Rockefeller Institute for the Study of Animal Diseases which is being built near Princeton at a cost in the neighborhood of a million dollars, have started their work in a suite of four rooms loaned by the biology and geology departments of Princeton University. The buildings of the institute will be on a tract of 480 acres, lying near the Walker-Gordon farms and are expected to be completed within a year.

Dr. A. F. Blakeslee, professor of botany and genetics, has taken up his work as plant geneticist at the Carnegie Institution Station for Experimental Evolution at Cold Spring Harbor, where he succeeds Dr. George H. Shull, who has become professor of botany at Princeton University.

The Field Museum of Natural History announces the appointment of Dr. Berthold Laufer as curator of anthropology to succeed Dr. George A. Dorsey, resigned.

Mr. W. G. Craib, assistant for India in the Kew Herbarium, has been appointed assistant to the professor of botany in the University of Edinburgh. Mr. J. Hutchinson succeeds Mr. Craib at the Royal Gardens.

R. A. Jehle has been appointed plant pathologist of the Florida Plant Board. His work will be investigation of citrus canker, a serious disease of citrus fruits, which was probably introduced into the United States from Japan a few years ago. His address will be Homestead, Florida.

Professor W. S. Franklin will make a tour of the universities and technical schools of the south and west during the coming fall and winter; and he offers to give, in connection with this trip, a number of theoretical and experimental lectures. Professor Franklin may be addressed during October and November at Columbia University, New York City.

At the forty-third annual meeting of the American Public Health Association, held in Rochester, N. Y., September 6 to 10, under the presidency of Professor William T. Sedgwick, of the Massachusetts Institute of Technology, the following officers were elected: President, Dr. John F. Anderson, director of the hygienic laboratory of the United States Public Health Service, Washington, D. C.; first vice-president, Dr. George W. Goler, health officer of Rochester, N. Y.; second vice-president, Dr. Charles J. Hastings, medical officer of health, Toronto, Canada; third vice-president, Dr. Omar Gillette, of Colorado Springs, Colo.; treasurer, Dr. Lee K. Frankel, of New York (reelected); secretary, Professor Selskar M. Gunn, of Boston (reelected). The following were elected to honorary membership in the association: Surgeon-General William C. Gorgas, United States Army; Dr. Stephen Smith, of New York, a member of the State Board of Charities; Dr. Frederick Montizambert, of Ottawa, director general of public health of the Dominion of Canada; and Dr. Henry D. Holton, of Brattleboro, Vt.

Professor Henry R. Francis, of the Landscape Extension Service of the College of Forestry at Syracuse, is completing a field study of the 300-mile highway which is being planned by the Massachusetts Forestry Association and which will run from Boston westward nearly to the New York line and then turn back eastward to Cambridge.

Nelson C. Brown, professor of forest utilization in the State College of Forestry at Syracuse, has returned from a 6,000-mile trip

through the National Forests of the Rockies and Cascades.

DR. DAVID MARINE, of the H. K. Cushing Laboratory of Experimental Medicine, Western Reserve University, has returned from Compiégne, France.

MISS MARY C. BLISS, instructor in botany in Wellesley College, has been granted a year's leave of absence for graduate work at Radcliffe College.

MR. H. M. JENNISON, assistant professor of botany and bacteriology in Montana State College, will spend the year in research work in the Missouri Botanical Garden.

A MEMORIAL to the late Dr. Hugh Dewar was unveiled in the Abercorn Public Gardens, Portobello, Edinburgh, on September 5. It bears the following inscription: "This fountain has been erected in remembrance of Dr. Hugh Dewar, Portobello, by his grateful patients and numerous friends, who deplore the loss in the prime of manhood of a kind friend and skilful and beloved physician. His quiet charity was known to the needy. 1866–1914."

DR. WILLIAM WATSON, from 1865 to 1873 professor of mechanical engineering and descriptive geometry in the Massachusetts Institute of Technology, since 1884 recording secretary of the American Academy of Arts and Sciences, has died in his eighty-second year.

HOWARD A. NELSON, a graduate student at the University of Minnesota, was drowned while engaged in work on the state and federal geological survey near Ely.

PROFESSOR KUNCKEL, docent for chemistry at Rostock, has died at the age of forty-seven years.

BY the will of the late Dr. Dudley P. Allen, formerly professor of surgery in the Western Reserve University, $200,000 has been set aside as a permanent endowment fund for the Cleveland Medical Library.

THE library of the University of Washington has acquired a complete set of the *Philosophical Magazine* from its establishment in 1798 at a cost of approximately $1,000.

THE war is responsible for the disappearance of two medical papers, the *Allegemeine Wiener medizinische Zeitung,* established sixty years ago, and the *Prager medizinische Wochenschrift,* established forty years ago.

THE awards granted to the Bausch & Lomb Optical Co., at the Panama-Pacific Exposition aggregate four "grand prix," or highest awards, one medal of honor and one gold medal. The award in each case was the highest prize granted. The four classes in which Bausch & Lomb Optical Co. received the "grand prix" are optical instruments, balopticons, engineering instruments and range finders. The first division, called optical instruments, covers seven classes and covers the company's ophthalmic lenses, microscopes, parabolic and Mangin mirrors, field glasses, microtomes and magnifiers. A medal of honor was awarded Bausch & Lomb photomicrographic apparatus; their photographic lenses received the gold medal.

THE New York State College of Forestry at Syracuse has received a valuable gift of 120 mounted game and water birds, and 21 mounted mammals from Congressman Peter G. Gerry, and his brother, Robert L. Gerry, both of Providence, Rhode Island. This collection was secured for the college through the interest and help of Dr. William T. Hornaday, director of the Zoological Garden at Bronx Park. Dr. Charles C. Adams, forest zoologist of the college, had presented to Dr. Hornaday earlier the urgent need of the college for mounted birds and mammals. Soon after this Mr. Robert L. Gerry wrote to Dr. Hornaday about the disposal of the Gerry game collection, as it will be called by the college, and Dr. Hornaday recommended that the collection be turned over to it. Such a collection of mammals and birds is of very great value in training foresters, not only to enable them to know at sight the important game and water birds and forest mammals, but also as an aid to an appreciation of their relation to the forest. In some localities in the west the Federal Forest Service wardens are required also to be game wardens. The administrator of forest lands

needs not only to be intelligent on game if he is to execute the laws properly, but he needs furthermore to know the influence of game and fur-bearing animals upon forests.

Curator W. C. Mills, of the Ohio Archeological and Historical Society, and also of the Archeological Museum of the Ohio State University, has this summer been excavating a mound situated on the farm of State Senator W. D. Tremper. It has yielded hundreds of valuable specimens, which show remarkable skill in the art of graving and carving. In addition, there is evidence that here in this mound communal or tribal relations existed, for instead of numerous individual graves, one common grave served for the receptacle for hundreds of bodies. There are many other characteristics, which make this mound stand out. For instance, it was found that a wooden palisade had been erected around it. It was also discovered that the builders worked in quartz and several specimens were obtained. The Tremper mound is in form that of an animal enclosed by an embankment or wall. It is 250 feet long, with an average width of 50 feet and a maximum height of 8½ feet. Because of its resemblance to an animal it early became known as the Elephant Mound, although recent exploration has proved this formation to be incident to its use and construction and not intended to represent an animal.

Probably the most accurate method for the determination of the value of the strength of an electrical current in absolute measure is by means of the Rayleigh current balance, in which the current to be measured is passed in series through two parallel circular coils of unequal radii, one of which is suspended from the beam of a balance. The distance between the planes of the coils is varied until the force of attraction between the two coils is a maximum, and the value of the force is obtained by adding weights to the other arm of the balance until its equilibrium is restored. Since the maximum force obtainable depends on the ratio of the radii of the coils alone, and not on their individual dimensions, it is only necessary to determine further the ratio of the radii of the coils, and this may be done with great accuracy by electrical means. The constant of the instrument, that is, the maximum force per unit current for the coils in question, has been obtained in the past by interpolation between values of the force, calculated for various assumed distances of the coils, in the neighborhood of the critical value for which the force is a maximum. For, although the general formulas of Maxwell and Nagaoka give the value of the force for any two given coils, at any assumed distance with great accuracy, no formula has been heretofore published for calculating at what distance the force becomes a maximum. To supply this lack there is derived in a paper just published by the Bureau of Standards, Department of Commerce, entitled "The Calculation of the Maximum Force between Two Parallel, Coaxial, Circular Currents," a formula which gives the critical distance as a function of the ratio of the radii. The latter part of the paper is devoted to the development of methods for facilitating the calculations. The formulas are illustrated by numerical examples and tables, and the new formulas are shown to give results in agreement with those derived by more indirect and laborious method of interpolation. Copies of the publication, Scientific Paper No. 255, may be obtained on request of the Bureau of Standards, Washington, D. C.

UNIVERSITY AND EDUCATIONAL NEWS

A colonial mansion at 4037 Pine Street, Philadelphia, modeled after Washington's Mount Vernon home, has been purchased by the Mask and Wig Club, the University of Pennsylvania dramatic organization. After extensive alterations it will be turned over to the university as a gift to be used as the official residence of Pennsylvania provosts. The value of the gift exceeds $75,000.

Professor Charles A. Kofoid, professor of zoology, University of California, is on sabbatical leave for the current academic year. He is spending the first half of it in research work in Berkeley and will travel in the Orient

after January 1. Associate Professor S. J. Holmes has been granted leave of absence for the current academic year on account of ill health. Dr. R. Ruggles Gates, of the Missouri Botanical Garden, has been appointed acting associate professor in zoology for the current academic year, and Assistant Professor J. Frank Daniel has been made acting head of the department of zoology. Professor Robert C. Rhodes, professor of biology in Henderson Brown College, Arkadelphia, Arkansas, and Instructor Harry B. Yocum, of Kansas State Agricultural College, have been appointed assistants in zoology.

THE new professional school of chemistry of the University of Pittsburgh began its work on September 27, under the deanship of Dr. Raymond Foss Bacon, director of the Mellon Institute of Industrial Research. A prescribed four-year undergraduate curriculum leads to the degree of bachelor of chemistry, and the staff of instruction includes the regular faculty of the university and fellows from the Mellon Institute of Industrial Research who are especially qualified in various theoretical and technical branches. This combination gives the new school the opportunity to offer not only the usual undergraduate and graduate courses in chemistry and technology, but also specialized work under men who are experts in specific American industries. In addition, thirty special lectures by prominent chemists and technologists in the Pittsburgh district, have been arranged for the academic year 1915–16. Attendance at these lectures is required of the student body and they are also open to the public. The professorate of the new school is constituted as follows: Alexander Silverman, M.S., professor of chemistry and head of the department of inorganic, analytical and physical chemistry; David S. Pratt, Ph.D., professor of chemistry and head of the department of organic, sanitary and micro-chemistry; Samuel R. Scholes, Ph.D., E. Ward Tillotson, Jr., Ph.D. and Edmund O. Rhodes, M.S., professors of applied chemistry; Benjamin T. Brooks, Ph.D., professor of chemical engineering; William A. Hamor, M.A., professor of chemistry; Henry A. Kohman, Ph.D. and Harold Hibbert, ScD., professors of applied organic chemistry; Leonard M. Liddle, Ph.D. and R. Phillips Rose, M.S., professors of organic chemistry; Lester A. Pratt, Ph.D., professor of inorganic chemistry, and C. C. Vogt, Ph.D., professor of physical chemistry. Thirteen assistant professors and ten instructors complete the teaching staff of the school.

AT Lafayette College, Dr. Beverly W. Kunkel, of Beloit College, has been appointed head of the department of biology, and Dr. William Mackay Smith, of the University of Oregon, professor of mathematics.

DR. ROBERT CHAMBERS, JR., assistant professor of histology and comparative anatomy in the medical department of the University of Cincinnati, has resigned to accept a position on the staff of Cornell Medical College.

DR. HAROLD KNIEST FABER (A.B., Harvard, 1906; M.D., University of Michigan, 1911), formerly connected with the Rockefeller Institute for Medical Research, New York City, has been appointed assistant professor of pediatrics at the Stanford University Medical School.

WILLIAM WEBB KEMP, a graduate of Stanford and Ph.D. of Columbia, now professor of education in the University of Montana, has been appointed professor of school administration in the University of California.

DR. MAURICE PARMELEE is taking the place of Professor A. E. Jenks, chairman of the department of sociology and anthropology of the University of Minnesota, for the first semester of the present academic year.

DR. FRANK A. HARTMAN, of the department of physiology in the Harvard Medical School, has been appointed lecturer in physiology at the University of Toronto.

H. G. PLIMMER, F.R.S., pathologist to the Zoological Society, has been appointed professor of comparative pathology in the Royal College of Science, London.

PROFESSOR ADOLF WINDAUS, of Innsbruck, has succeeded Professor Otto Wallach as director of the chemical laboratory at Göttingen.

DISCUSSION AND CORRESPONDENCE

CONVENIENCE VERSUS FITNESS

In recent numbers of Science a series of articles[1] has appeared pleading for the conservation of the genus as known in the early days of biology, to the sacrifice of explicitness in nomenclatural recognition of the modern increase in morphological knowledge.

As clearly recognized by Sumner[2] this is a continuation of the plea of convenience in behalf of the *status quo* that has marked recent controversies over zoological and botanical nomenclature, and is voiced by and in behalf of the same classes of objectors—the general zoologist, the amateur, the college professor, and the "true nature lover." The case of the protestants has been quite fully and ably presented in the first paper of the series, and somewhat amplified and further illustrated by the other two contributors. To reply to their points seriatim is beyond the scope of the present article, but a few words may be offered from the other point of view, that of the berated "taxonomists."

In the opening article of the series it is said:

> But there is another perennial source of confusion which has not received adequate attention. Apparently it is regarded as quite unavoidable, or perhaps it is not commonly thought of as a difficulty of *nomenclature* at all. I refer to the continual changing of names that results from the subdivision of genera. . . . And if we look for the distinctions upon which these subdivisions are based, we commonly find that the differences are very trifling indeed in comparison with the many and detailed points of resemblance between these various groups.[3]

The same author further states:

> . . . it must be borne in mind that in the Linnæan system of binomial nomenclature the generic name plays two quite distinct rôles. One of these is to designate a taxonomic group, supposed to be intermediate between the family and the species. The other is *to form the first half of the "scientific" name of each species within that group.* It is for this reason that the changing of a generic name is so much more disconcerting than is changing that of the family or order. And this is why, in the writer's opinion [he describes himself in a preceding paragraph as "one who is not a taxonomist at all"], such splitting as we have just recognized to be inevitable should be done *within the limits of the genus,* either by the creation of "subgenera," or, if necessary, by the establishment of wholly new categories between the genus and the species.[4]

In other words, any method that will avert the direful interposition of a new generic name!

The second contributor to the discussion says:

> Few zoologists ever stop to think how far we are getting away from a real binomial system of nomenclature. It is true that scientific names of animals still consist of two words, but only in a minority of cases does the first term of the binomial have any real meaning to us, or suggest ideas of a much broader and more comprehensive character than the second one. The genus name has become little more than a prefix to, or part of, the species name. . . . We learn generic names, if we learn them at all, by mere acts of memory, and we use them because we find them in the latest monographs and might be thought not up to date if we did otherwise, but what the distinctions are between these multitudes of closely allied genera we rarely stop to enquire.[5]

Notwithstanding this naïve confession, the author admits the utility of such minor divisions if they are not permitted to affect nomenclature.

> They exist in nature and should have a recognition commensurate with their importance. . . . Classification has gained in exactness and truthful representation of the facts, but through our neglect to keep the first term of our scientific names comprehensive in its application, and easily distinguished and remembered in its meaning, we have allowed our nomenclature to lose most of the prac-

[1] Sumner, F. B., "Some Reasons for Saving the Genus," Science, N. S., XLI., No. 1068, pp. 899–902, June 18, 1915. Van Name, Willard G., "Losing the Advantages of the Binomial System of Nomenclature," Science, N. S., XLII., No. 1075, pp. 187–189, August 6, 1915. Colton, Harold S., "Another Reason for Saving the Genus," Science, N. S., XLII., No. 1079, pp. 307, 308, September 3, 1915.

[2] *L. c.,* p. 899.

[3] Sumner, *l. c.,* pp. 899, 900.

[4] *Ibid.,* p. 900.

[5] Van Name, *l. c.,* p. 187.

tical advantages and conveniences of the Linnæan system.[6]

The author of the third article cited above places great stress upon the fact that "It is by genera that animals and plants are catalogued," and considers that "this whole discussion hangs on the question, is it necessary to change generic names to advance our knowledge?" He goes on to reiterate:

> In conclusion, generic names are those by which animals are catalogued, therefore should not be changed without overwhelming evidence in favor of the change. This value of the generic name has not been sufficiently emphasized.[7]

These three writers (for they all harp essentially on the same string) seem, despite all their admissions, really to forget that increase in knowledge leads in all fields of scientific progress to the introduction of new technics. It is not only necessary to learn new facts but new terms for their expression. In the good old days of the last half of the eighteenth century and the early part of the nineteenth, zoological genera were few; and when those founded by the great Linnæus proved, in the opinion of his immediate successors, to be inadequate to satisfactorily meet the requirements of their new discoveries, they proposed what were in fact new generic groups, but in deference to the past apologized for their seeming disrespect of the *status quo* and demurely called them subgenera, to break the shock of their seeming irreverence. Yet as years passed these groups gradually took their place in the systems as valid genera, and more were constantly added. The old Linnæan genus *Mus* included at first marmots and flying squirrels, as well as all the rat- and mouse-like animals then known. All known deer and antelope were each included in a single genus, and so on through many other groups.

More than one eighteenth century genus has since been distributed into several *families,* to say nothing of genera. And what an inconvenience this must have been for the "general zoologist" to have to learn so many new generic names! What a trouble it must have been too for the cataloguer! But such is the history of science, and who is to say when we have genera enough, and how many shall be weeded out as merely useless and confusing, and how many more may be conserved as subgenera, and thus save the present-day overworked "general zoologist" and his fellow sufferers from knowing that such divisions and names have ever been proposed by the poor specialists who were so misled in their researches as to think them necessary.

I must confess, however, that I share the weaknesses of my class, the specialists, in believing that the primary function of nomenclature is to express the facts of classification, not to conceal them. The old genus *Sciurus,* in its early sense, comprised all squirrel-like animals of all parts of the world. In its old sense it would now comprise several hundred species, all looking near enough alike to be called squirrels, yet containing a score or more natural groups, sharply defined geographically and by minor but not unimportant morphological characters. Many of these minor groups are now currently given the rank of genera, others stand as merely sections or subgenera. Arranged thus in a monograph or in a systematic catalogue their various degrees of relationship and their interrelationships might be approximately expressed, but incidental references to them under the single generic name *Sciurus* places all on the same level, with no clue as to whether they are closely or remotely related, or to the kind of squirrel intended. If on the other hand they are mentioned under their modern group names the specialist knows, and the general zoologist should know, exactly their relationship to other squirrels, in other words, what kind of a squirrel is indicated. But this is apparently of no importance to advocates of "convenience" as the prime factor in every matter relating to nomenclature.

An intelligible compromise would be the use of both the generic name (in the broad sense) and the subgeneric name (in parenthesis) in incidental references. But this would be intolerable in the general zoologist, as it would, in the case of subspecies, involve in effect a quadrinomial nomenclature, and a further departure from the primitive binomial of the

[6] *Ibid.*, p. 187.

[7] Colton, *l. c.*, p. 308.

good old times of thirty to fifty years ago when (to quote Van Name), "a genus name had in those days a real meaning to some others besides the specialists in the class of animals to which the genus happened to belong."[8]

It is of course to be admitted that there are good genera and bad genera; that many groups have been proposed as subgenera or even full genera on inadequate grounds. Our synonymies show what has been the fate of many of them, and a like fate doubtless awaits many, of recent origin, that have still to be weighed in the balance of concurrent approval. As the value of characters is a question that can not, from its nature, be made the subject of rules, as can questions of nomenclature, there seems only the slow relief afforded by time and the concurrent judgment of the specialists of each field for the evils of too much subdivision.

J. A. Allen
American Museum of Natural History,
New York

THE INHERITANCE OF CANCER

In a short note[1] I have recently commented on Dr. Maud Slye's work on the inheritance of cancer in mice. As to the credit due Dr. Slye for her careful and laborious experiments there can be no question. The importance of the subject, however, is such that it is essential to understand the exact distinction between the gathering of valuable data and the interpretation of such data when gathered.

The impression that Dr. Slye believed that cancer was inherited in a Mendelian fashion appears to have been more or less generally created by her paper already mentioned. Any one reading the editorial on her work in the *Journal of the American Medical Association* (Vol. 64, p. 1,326) can not fail to see that the "great laws" of heredity mentioned there are intended to be the Mendelian laws. The whole subject is treated from that standpoint and the optimism apparent must be considered to be chiefly due to the belief that Dr. Slye's work is an example of Mendelian inheritance.

So too, any one reading the review of recent work on cancer research by Dr. W. A. Dennis in the *St. Paul Medical Journal* (Vol. 17, pp. 494–500) can see that he believes that

> . . . the importance of her findings lies in the fact that hereditary transmission . . . is not fortuitous but that, given parents of pure breed the results of crossing may be confidently predicted.

After outlining correctly the basic principles of Mendelian inheritance, with the cross of albino and gray mice as an example, Dennis goes on to say:

> Maud Slye has taken advantage of this law [Mendel's] of heredity to study the transmissibility or inheritability of cancer in mice. . . . These studies [Slye's] have shown that the appearance and numerical value of the albino character can be predicted with certainty from the manner of mating the parents. The same is true of the whirling character of the Japanese waltzing mouse *and the same has been demonstrated to be true of cancer.*[2]

The fact that no correction of the impression so created was apparently forthcoming, and the fact that the diagrams in Slye's paper showing the inheritance of albinism represented a hitherto undescribed type of heredity led me to comment on her work.

Slye's recent denial of any desire or intention to apply a Mendelian interpretation to her experimental results is an extremely important postscript to her paper since it makes it virtually impossible to expect the exact numerical predictions in crosses which her reviewers have believed could be made.

Further than this, Slye's beliefs as to the inheritance of albinism are, as I have stated before, at sharp variance with the experimental results of Castle, Allen, Bateson, Durham, Cuénot, Plate, Davenport and others. The suggestion made by Slye[3] that the utilization of wild grays rather than "artificial laboratory" grays places her work in a position different from that of these other investigators is not significant, for I have repeatedly used wild grays in my crosses and have found that their hybrids obey Mendel's law in respect to the color characters which they inherit.

I have suggested that Dr. Slye's data show-

[8] *L. c.*, p. 187.

[1] Science, N. S., Vol. 42, pp. 218–219.

[2] *Italics mine.*

[3] Science, N. S., Vol. 42, pp. 246–248.

ing the non-Mendelian inheritance of albinism be published. To this she has replied that this data "in no way affects the transmission of cancer." I can only add that when one investigator suggests a revolutionary hypothesis which is contrary to the experimental results obtained by a large number of investigators in the same field, it is customary to present with the hypothesis the data on which it depends for its support.

Dr. Slye is right when she says in speaking of heredity,

> Exceptions to what was the canon have become so numerous as to be part of the rule.

One of the few points, however, on which all Mendelians, rabid or only semi-rabid, are agreed is that a homozygote forms one type of gamete in respect to the pair of factors for which it is homozygous. This is the principle which by diagrams and text Dr. Slye denies. Is it not fair to those who have not observed the type of inheritance mentioned by Slye to once more request the publication of the complete data on which this type of inheritance rests?

C. C. LITTLE

HARVARD MEDICAL SCHOOL,
September 7, 1915

THE HEREDITY OF STATURE

TO THE EDITOR OF SCIENCE: The undersigned is making a study of the heredity of the elements of stature and desires the cooperation of those who are in a position to give it.

The first requirement is a household with both parents and at least two children above the age of 16 years; the more children above this age the better. If one or more grandparents, uncles and aunts are available they should be included in the study. The second requirement is a tape, if possible, 6 feet long, but a yard tape will do.

The procedure is to rule columns on ordinary writing paper, one column each for father, mother, each child and also each grandparent or uncle or aunt who may be available. The first horizontal line will be for sex; the second for age and the following four for the four measures. Then measure and record for each person: 1, total stature (without shoes); 2, sitting height; 3, height of top of fibula above sole of foot and, 4, vertical distance from vertex of head to depression at upper end of sternum (between the collar bones). The only suggestions are: (1) The stature may be taken standing against a door frame; the subject looking straight forward, a book is placed, binding downward, against the top of the head and square with the wall; mark the level of the book on the door frame and measure down to the floor. (2) Place the chair by the door frame; place subject sitting upright in chair, his back against door frame; indicate level of vertex in same fashion as in standing height and measure from mark to the level of the seat of the chair. (3) The top of the fibula is easily felt on *outside* of knee as a bony prominence from which a tendon runs to the thigh. (4) The head-and-neck measurement is to be strictly vertical. Place the 0 end of tape in the book; close the book so that the 0 mark is flush with the binding. The subject standing by wall, place book square against wall; then measure down along side of the nose to the sternum. All measurements should be recorded in ½ (or ¼) inches or in centimeters. Full names are desired for reference in case further correspondence is necessary but no names will be published.

It will be found interesting to preserve a copy of the record but please send one copy to me. If desired I will send ruled paper and a tape for the measurements.

C. B. DAVENPORT

STATION FOR EXPERIMENTAL EVOLUTION,
COLD SPRING HARBOR, N. Y.

THE NATIONAL ACADEMY OF SCIENCES

IN SCIENCE of July 30, Professor Richards has made public a letter addressed by him to the secretary of the National Academy. In this letter he volunteers advice to that learned body. He appears to think that it should cease to exist, because it covers too wide a field. Astronomers, biologists, chemists, physicists, zoologists, etc., should not be provided with any opportunity to mix even if they desire to do so. A man who has been giving his entire attention to the abdominal parasites of the white ant, should present his results to a society covering that ground only.

I have listened to papers presented to the Mathematical Society, which were wholly unintelligible to me, and I learned on inquiry on one occasion that two of the foremost mathematicians in the country, who were present, were equally in the dark. Such exhibits are often presented by men who are ambitious to say something, and who have nothing of any importance to say. It is difficult to give advice to them, it is a somewhat delicate matter, but they need advice. Many technical details which are not only proper, but necessary in a published paper, may be omitted in the oral presentation of that paper. Any person of ordinary good sense should know how to adapt an oral presentation to an audience.

There is a growing tendency among a certain class of scientific men, to lose all interest in everything outside of their own narrow horizons. This is much to be regretted. But such men have their remedy in their own hands. No one can object to the formation of physical or chemical societies, but it is to be hoped that we are not all so limited in our horizons that we shall advise academies of science to cease to exist.

Francis E. Nipher

A PROPOSED ECOLOGICAL SOCIETY

At the Philadelphia meeting of the American Association for the Advancement of Science about twenty men interested in ecology met informally on the evening of December 30, 1914, to consider the advisability of organizing an American Ecological Society. The immediate occasion for the conference was an expression of feeling on the part of Professor R. H. Wolcott and Professor V. E. Shelford to the effect that there is now no adequate opportunity for plant and animal ecologists to meet together, and also that there is for ecologists an urgent need of summer field meetings in addition to the present winter meetings.

The conference was attended by Messrs. Adams, Bartlett, Blodgett, Bray, Cannon, Cowles, Dachnowski, Griggs, Harshberger, Hill, Jennings, MacDougal, Nichols, Pearse, Shantz, Shelford, Shreve, Taylor and Wolcott, Professor Harshberger being selected chairman. The opinion was practically unanimous that the time is ripe for the organization of an Ecological Society, and it was voted, in connection with the Columbus meeting of the American Association, to call a conference of all ecologists interested in the formation of such a society. A committee was appointed to call such a conference and present a scheme of organization, the committee consisting of Professor J. W. Harshberger (chairman), Professor V. E. Shelford (vice-chairman), Professor H. C. Cowles (secretary-treasurer), Professor R. H. Wolcott, Professor Charles C. Adams, Dr. Forrest Shreve.

Announcement will be made later of the exact time and place of the Columbus conference, but it may be assumed that it will not be earlier than Tuesday, December 28, nor later than Thursday, December 30, 1915. The purpose of this early announcement is to give ample opportunity for full expression of opinion. It is hoped that all working ecologists will write to the undersigned, noting (1) whether the proposed society is favored or disfavored and why, and (2) whether attendance at the Columbus conference is to be expected.

Henry C. Cowles

University of Chicago

GREENE VARDIMAN BLACK

To the Editor of Science: Will you permit me to call attention to the death of Dean Greene Vardiman Black? He was a figure of world-wide importance. Even before he was called to the deanship of Northwestern University Dental School he had established an international reputation as a man of science, and I think it fair to say that no man in his time—perhaps in any time—has done more to advance his profession.

He brought to his work a broad general and sound scientific training. He had the natural equipment of a man of science. It was his research work which developed and practically gave to the world the amalgam of to-day. He was the inventor of one of the first cord driven, foot power, dental engines. His scientific contributions number nearly one thousand.

He has been recognized by medical and scientific societies in this country and abroad. Five years ago he was given an appreciation banquet by the Chicago Odontographic Society. Among the delegates were many from distant places in the United States, and gifts were received from this and foreign countries.

In 1912, he was the recipient of the Miller prize of the International Dental Federation. Dr. Black was the first to receive this medal, and the award was made to him because of his researches and work in many branches of dental science. The medal was delivered personally by Floristan Aguilar, of Madrid.

At Northwestern, he found a school of moderate equipment which he built up until it acquired a world-wide reputation, and it has become in size one of the largest, if not the largest in the country. His former pupils are scattered over the world—in almost every civilized country—in America, in Europe, Asia, Africa and Australia. He is one of the outstanding great figures in professional education in this city.

His two great works are "Dental Anatomy" and "Operative Dentistry," which are standards in dental schools of to-day.

A. W. HARRIS
NORTHWESTERN UNIVERSITY

SCIENTIFIC BOOKS

Selected Papers. Surgical and Scientific, from the writings of Roswell Park, late Professor of Surgery in the University of Buffalo and Surgeon-in-Chief to the Buffalo General Hospital. With a memoir by CHARLES C. STOCKTON, M.D. Published by the Courier Company, Buffalo, N. Y. 1914. Pp. 381.

No finer memorial could exist for Roswell Park, surgeon, scientist, litterateur, historian and educator, than this book of papers selected from the huge list of writings, the bibliography of which shows the extent of his surgical interests.

These selected papers, including one of Dr. Park's earliest, as well as the very latest paper prepared by him, portray vividly how during his thirty-six most active years his surgical and scientific interests developed and expanded. Especially does one wonder at the amount of work accomplished during the last five years of his life as shown by the output of no less than twenty-one important papers, each of which bears evidence of active laboratory research and hours of library study.

Many of these papers are distinctly technical in character, but whether discussing the intricate details of a difficult surgical technic or the results of laboratory researches, Dr. Park never loses sight of the ultimate aim of surgical technic and laboratory findings—their humanitarian significance.

One is particularly impressed with the keen intellect, which, in the midst of large surgical activities and the stress of ill-health, could study and digest such scientific details, along other than his own special lines of research, as are included in the references listed after the paper "Of What Does the Universe Consist?" His interest in radioactivity, however, is but one of the many instances in which he made an absorbing study of some new physical or chemical discovery, that he might discern its widest clinical application.

One must read between the lines of these papers the important part played by Dr. Park himself in the researches which he discusses. Another writer of the history of carcinoma, for example, would carry his account to a later date and would not fail to speak of Dr. Park as the prime mover in the establishment of the Gratwick Laboratory, now the New York State Laboratory and Hospital for the study of Malignant Diseases. So also in writing of "The Present Status of Antiseptic Surgery" and the "Primary Antiseptic Occlusion and Treatment of Gunshot Wounds," another writer would speak with enthusiasm of Dr. Park's early acceptance of the principle of antisepsis, and of his studies of infections, which were the prime reason for his appointment to deliver the Mütter Lectures on Surgical Pathology at Philadelphia in 1892.

The brief biography by Dr. Charles T. Stockton is satisfying in its delineation of those periods and experiences in Dr. Park's life which contributed most to make him the man whom his fellow citizens, his pupils, his

surgical colleagues and fellow scientists knew, admired and loved.

G. W. Crile
Cleveland, Ohio

Societal Evolution: A Study of the Evolutionary Basis of the Science of Society. By Albert Galloway Keller, professor of the Science of Society in Yale University. New York, The Macmillan Co., 1915. Pp. 330. $1.50.

Some years ago when he was professor of political and social science in Yale University, William Graham Sumner introduced the term "societal" into sociological terminology. His purpose was to employ a word more definite than "social" in order to emphasize the distinctively collective or group activities of individuals. "Social," he thought, had too many meanings to be exact. Following this usage, Sumner included in his remarkable book, "Folkways," an interesting chapter on what he termed "societal selection." In most concrete fashion did he therein show how by group or "societal" action, various "folkways" and "mores," as he termed them (*i. e.*, customs), whose origin is often obscure, are more or less consciously and intelligently chosen or "selected" by the group, become authoritative and finally compel conformity.

Professor Keller, modestly characterizing the present volume "as an extension of Sumner's work," employs "societal" in his title and in the main accepts Sumner's conceptions as a basis for his own contributions. The extension consists essentially in an endeavor to show both that there is "societal" evolution and that the manner in which such evolution occurs can advantageously be stated in terms employed by Charles Darwin in the biological field. To use Professor Keller's own language: "The question I have asked myself is: can the evolutionary theory, according to Darwin and his followers . . ., be carried over into the social domain without losing all or much of the significance it possesses as applied in the field of natural science?" He expressly denies that the eugenists in their attempts to prove the effectiveness of natural selection in human society have really attacked this general issue. Professor Keller considers that natural selection is a term which in a very literal sense can and ought to be applied in the theory of social evolution not only with a strictly biological meaning, but also with a social, or, shall we say, "societal" meaning? He finds "a something in the social field which *is* variation, whether or not it may be like what is called variation in the organic field; similarly, social selection *is* selection and not merely *like* it." This "something" appears to be the differences among those customs which Sumner called folkways and mores. In conformity with this conception there are chapters on "variation," "automatic and rational selection," "counter selection," "transmission" and "adaptation." In these chapters occur many interesting instances of transformations in customs interpreted as illustrations of the processes just named.

The author vigorously defends his application of these Darwinian terms to social phenomena. "I shall be charged, doubtless," he says, "'with reasoning from analogy,' but I do not feel that the charge is deserved." To the present reviewer, however, there is a question raised by the use Professor Keller makes of these terms and the manner in which he deals with certain parts of his material, far more important than a possible "reasoning by analogy" of which he seems apprehensive. "Reasoning by analogy" is perfectly legitimate if thereby the reasoner develops a hypothesis that is capable of independent proof. Thus the known refrangibility of light and heat, Spencer tells us, produced the inquiry as to whether sound is not also refrangible. On investigation this proved to be the case. The analogy led to discovery. If in the present instance valuable discoveries had resulted from a use of an analogy, no one could have objected. Such, however, does not appear to be the fact. Many, if not practically all, of the important actual social processes emphasized by Professor Keller have been clearly discussed at one time or another by various sociological writers without unnecessary resort to biological phraseology. Even Walter Bagehot in "Physics and Politics," which he subtitled

"Thoughts on the Application of the Principles of 'Natural Selection' and 'Inheritance' to Political Society" did not particularly stress the importance of the biological terms he at times employed. Although in one passage Bagehot refers to natural selection among animals and in human history as "identical in essence," he nevertheless in the very next paragraph remarks concerning his use of the term: "At all events to the sort of application here made of it [*i. e.*, in 'Physics and Politics'], which only amounts to searching out and following up an analogy suggested by it, there is plainly no objection." Bagehot points out, as does Keller, the fact that differences in customs affect the efficiency of rival groups and may thereby indirectly affect the chances of survival possessed by their observers. Bagehot went on, as does Keller also, to treat in a very broad way the relation of custom, of unconscious imitation, of reason and of many other factors to the survival and progress of groups and nations. Bagehot did this, however, without at all falling into the confusion necessarily produced by ignoring or rather obliterating by a *tour de force* the plain distinction between natural selection in the strict Darwinian sense and the same term loosely used for natural conscious or unconscious social choices. Transference of biological terms into the sociological field and use of them in the literal fashion employed by Professor Keller does not offend so seriously in "reasoning by analogy" as it does in what seems to the reviewer a misleading and scientifically illegitimate use of precise biological terms. There is no need to repeat in a somewhat different form the sort of thing which followed Spencer's application of the term organism to society.

The foregoing criticism, however, is very largely one of terminology and the careful reader will find much of great value in Professor Keller's book. The differences among customs, the ways in which various customs have originated, the effects of conscious and unconscious imitation, the relation of suggestion, of conflict and of reason to the development of specific customs—these and other special subjects are presented and illustrated in an interesting fashion.

A. A. TENNEY

PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES

THE ninth number of Volume 1 of the *Proceedings of the National Academy of Sciences* contains the following articles:

1. *The Indian and Nature:* ALICE C. FLETCHER, Peabody Museum, Harvard University.

   Glimpses are given of the line the Indian pursues in his endeavor to express his view of nature and of the relation he believes to exist between its various forms and forces and himself.

2. *The Mechanism of Antagonistic Salt Action:* JACQUES LOEB, Rockefeller Institute for Medical Research, New York.

   The author studies the effect of the concentration C_{III} of the salt at the external surface of membranes in addition to the concentrations C_I and C_{II} of the salt outside and inside the membrane and finds that C_{III} is serviceable in explaining the mechanism of antagonistic salt action in certain cases.

3. *The Nitrogen Problem in Arid Soils:* CHAS. B. LIPMAN, College of Agriculture, University of California.

   A summary of some recent investigations and field manifestations with reference to their bearing on problems of soil fertility in California.

4. *A Notation for Use in the Discussion of Star Colors:* FREDERICK H. SEARES, Mount Wilson Solar Observatory, Carnegie Institution of Washington.

   The extension of absolute scales of photographic and photovisual magnitudes to the fainter stars provides a method of determining the colors of objects at present beyond the reach of spectroscopic investigation and it is convenient in the statistical discussion of such color results to introduce a notation similar to that used for spectral classification. The letters *b, a, f, g,* etc., are used to correspond to *B, A, F, G,* etc.

5. *Distribution of Colors among the Stars of N. G. C. 1647 and M. 67:* Frederick H. Seares and Harlow Shapley, Mount Wilson Solar Observatory, Carnegie Institution of Washington.

Neither N. G. C. 1647 nor M 67 show any dependence of condensation upon color which can not be explained on the basis of included background stars; there seems to be little, if any, dependence of condensation upon magnitude; but there is a marked relation between color and magnitude in N. G. C. 1647 and a less pronounced relation in M 67.

6. *On Thiele's "Phase" in Band Spectra:* Horace Scudder Uhler, Sloane Physical Laboratory, Yale University.

The author outlines an interpolation method for determining c in the formula $\lambda = f[(n+c)^2]$, which is much simpler than using Thiele's complicated formula.

7. *Why Polar Bodies Do Not Develop:* Edwin G. Conklin, Department of Biology, Princeton University.

The second or internal factor in normal fertilization is a non-diffusible substance which is introduced by the spermatozoon, and it is strongly suggested that this factor is the sperm centrosome, a position which Boveri has long maintained and which the author has hitherto contested. Giant polar bodies do not develop because they are not fertilized and they are not fertilized because they are generally formed after a spermatozoon has entered the egg and has rendered it impervious to other spermatozoa.

8. *Radical Velocities of the Planetary and Irregular Nebulæ:* W. W. Campbell and J. H. Moore, Lick Observatory, University of California.

The fact that the gaseous nebulæ have motions which are characteristic of the stars, and their concentration in the Milky Way, indicate that these nebulæ are members of our stellar system. The great velocities of the nebulæ in the Magellanic Clouds and other considerations lead to the hypothesis that the Magellanic Clouds are isolated cosmic units with no apparent connection with our own stellar system.

E. B. Wilson

SOME CORRELATIONS BETWEEN VEGETATION AND SOILS, INDICATED BY CENSUS STATISTICS

Although most persons who have lived or traveled extensively in the rural districts of the eastern United States have probably noticed that the proportion of evergreens in the forests is usually greatest on the poorest soils, and *vice versa,* one rarely sees any mention of such a correlation in scientific, especially ecological, literature. Most plant ecologists who have taken notice of evergreens at all seem to try to correlate them with climate in some way; but the easily demonstrated fact that two areas so close together or so similarly situated that they must have essentially the same climate often differ greatly in their percentage of evergreens shows that climate is not the only factor.[1]

The making of definite correlations between evergreens (or other aspects of vegetation) and soils has always been difficult on account of the dearth of quantitative data. No reliable quantitative analysis of the vegetation of a whole state has yet been made, and it would take many years to do such a piece of work thoroughly. To estimate the average composition, either physical or chemical, of the soils of an area of more than a few square miles would be even more difficult, for no matter how many samples were collected and analyzed, the judgment of the persons selecting them would always introduce a "personal equation" factor, unless the samples were selected wholly fortuitously, or at regular intervals (for example, at the corners or centers of every section of land).

Our knowledge of the chemical composition of the soils of the United States is still far from satisfactory. In Bulletins 57 and 85 of the U. S. Bureau of Soils are summed up most of the available chemical analyses, by states, and for some states there are only two or three, and those probably not typical; and they are not all made by the same methods. In fact soil investigators are not yet agreed on what method gives the best indication of

[1] In this connection see Torreya 13: 244. 1913, *Rep. Mich. Acad. Sci.,* 15: 196–197, 1914; *Ann. Rep. Fla. Geol. Surv.,* 6: 175, 393–396, 1914.

productivity, or correlates best with the native vegetation.

In the reports of the Census Bureau there are statistics, made so thoroughly as to practically eliminate the personal equation, that throw valuable light on both evergreen percentages and soil fertility. The percentage of evergreens is one of the most conspicuous and easily determined features of vegetation that can be expressed numerically, and it is almost the only one (and certainly the most significant one) that can be calculated from existing census statistics.

In 1911 the U. S. Census Bureau and Forest Service jointly published an octavo bulletin (without a number) entitled "Forest Products of the United States, 1909," giving among other things the output of lumber, laths and shingles by the sawmills of the United States in the year named, by states and by species simultaneously. Similar statistics have been published for subsequent years, but those for 1909, which were gathered in connection with the regular decennial census, seem to be the most complete.

Other things being equal, the lumber sawn from deciduous and evergreen trees in a given area should be proportional to the percentage of those trees in the forests; but other things are not equal. In the first place, it is of course the percentage of evergreens in the primeval forests that counts, and as the deciduous trees prefer the richer soils, a larger proportion of them than of the evergreens have been destroyed by farmers in clearing land for cultivation. Second, the evergreens in the United States are mostly (counting individuals, not species) conifers, and conifers on account of their gregarious habit and straight-grained easily worked wood are more sought after by lumbermen than the hardwoods are.

In the census statistics of lumber production all the hardwood trees listed are deciduous. (Some evergreen hardwoods are cut in the southeastern states, but in insignificant quantities.) The figures for evergreens are therefore obtained by subtracting from the total for conifers those for the two deciduous genera, *Taxodium* and *Larix* (cypress and tamarack). To make allowance for the hardwoods that have been destroyed by farmers, and the neglect of the remaining ones by lumbermen, the figures for them (not for all deciduous trees) are arbitrarily multiplied by 4. This product added to the figures for conifers and divided into the total evergreens (not total conifers) gives a percentage which is believed to approximate pretty closely in most cases the percentage of evergreens in the original forests.

Some idea of the fertility of the soil in different parts of the country can be obtained from several different sets of figures in the census reports. In rural districts there is a close relation between soil fertility and density of population; but in the northeastern states so large a population is supported by manufacturing, independently of the subjacent soil, that statistics of population there would be of very little use in this connection. Figures showing the value of land are open to the same objection.

The census gives the acreage of "improved land" in the farms of each state and county, and that is undoubtedly correlated with soil fertility, whether the fertility is due to physical or chemical conditions or something else; and the tendency to utilize the land more fully in the neighborhood of cities is partly offset by the occupation of much land for other purposes than farming, and such land is not included under "improved land in farms." For the purposes of this investigation the statistics of improved land have been taken from the Tenth Census (1880), because earlier censuses are probably less complete, and because the use of commercial fertilizers has increased so much since then as to tend to obliterate differences in productivity between different kinds of soil.[2]

Another kind of statistics given for each state and county in recent census reports is the

[2] In the South some sandy soils which were regarded as almost worthless half a century ago are valued more highly at the present time than the rich clayey or calcareous soils, because they are more easily tilled, and yield large returns for the amounts invested in fertilizers.

expenditure for fertilizers for the year preceding that in which the census was taken. The ratio between that and the total acreage of improved land is certainly a function of the natural fertility of the soil, although it is of course governed by some other factors as well.[3] If we determine the relative fertility of different states or counties by striking an average between the results obtained from a study of the percentage of improved land and the amount of fertilizer used per acre perhaps we shall not be far wrong; and still greater accuracy might be obtained by using additional criteria of an analogous nature.

The present study is limited to the eastern half of the United States; because in the West farming is chiefly confined to areas originally treeless, and there is no necessary connection between the fertility of such areas and the composition of the forests in the same states, which may occupy very different soils. Massachusetts, Rhode Island and Connecticut are omitted because their large urban population, deriving most of its food from the farms of other states, complicates matters too much; New Jersey for a similar reason and also because its most abundant evergreen, *Pinus rigida*, is of little value for lumber and therefore does not figure very largely in the returns; and Illinois, Iowa and Minnesota for the same reason as the western states.

In the table below the 24 remaining states are arranged in the order of their evergreen percentages, as determined in the manner above described, with the highest first. The first column of figures contains these percentages, the second the percentage of the total area "improved" in 1880, and the third the amount spent for fertilizer in 1909 for each acre of improved land reported in April, 1910. The last column gives the average rank of the states as determined by columns 2 and 3. *E. g.*, Florida ranks first in proportion of unimproved land, and second in the use of fertilizer per acre, making its average rank 1½.

States	Per Cent. of Evergreens	Improved Land 1880	Fertilizer per Acre 1909-10	Average Rank
Florida	91.5	2.7	$2.00	1½
South Carolina	80.0	21.2	2.49	4½
Georgia	77.4	21.8	1.37	7
New Hampshire	72.2	40.0	.55	13
Alabama	68.2	19.5	.79	7
Maine	68.0	18.3	1.72	4
Louisiana	65.6	9.4	.38	7½
Mississippi	55.3	17.6	.30	9½
North Carolina	51.5	20.8	1.39	5½
Delaware	41.5	59.4	1.21	14
Virginia	36.1	33.0	.70	11½
Vermont	35.9	56.3	.35	17
Wisconsin	34.6	25.9	.01	18
Arkansas	30.3	10.7	.07	12
New York	26.8	58.1	.48	17½
Pennsylvania	24.2	46.8	.54	14½
Michigan	19.8	22.6	.07	16
Maryland	19.0	52.0	1.01	13
West Virginia	13.5	24.7	.10	15
Missouri	6.9	38.1	.03	19
Tennessee	4.7	31.9	.11	15½
Kentucky	2.3	41.8	.09	18½
Ohio	0.5	69.3	.22	20
Indiana	0.1	60.6	.13	20

The departure of the last column from a numerical sequence indicates how far the evergreen percentages and soil fertility, *as determined from census statistics*, from which the personal equation is practically eliminated, fail to correspond. The average difference between these figures and what they should be if the correlation were perfect is only 2¾, whereas if there were no correlation at all the probable average difference would be two or three times as great. The correspondence is as close as could reasonably be expected under the circumstances; and moreover, some of the discrepancies are easily explained.

For example, in Maryland, North Carolina and Tennessee a large proportion of the deciduous forest is in mountainous regions, too rough for farming but not for lumbering, so that the true evergreen percentages are probably higher than the figures indicate. In Mississippi and Louisiana the deciduous trees are mostly in swamps, which also repel farmers more than lumbermen. In New Hampshire, Vermont, New York and Wisconsin conditions

[3] Some persons with whom the writer has discussed the matter during the past year pretend to believe that the amount of fertilizer used depends mainly on the enterprise of the farmers, but they would hardly contend that the farmers of South Carolina and Florida are ten times as enterprising as those of Ohio and Indiana!

are somewhat reversed, the evergreens being mostly in places unattractive to farmers, and the apparent percentages of them probably too high. The percentage of improved land in West Virginia and Arkansas is rather low, perhaps chiefly because these states are off the main routes of travel and have not received as many settlers as their soil would warrant. It is low in Mississippi and Louisiana on account of large areas of alluvial land, which although very rich (and originally wooded almost exclusively with deciduous trees) were very little cultivated in 1880 on account of being subject to overflow. In the northern states improved land includes a large proportion of pasture, on which no fertilizer is used, and if the amount of cultivated land could be substituted for improved land the fertilizer figures for these states would average considerably more per acre.

Finally, it can not be doubted that different chemical elements in the soil affect evergreen percentages and other features of vegetation unequally, and it is well known that the composition of rich soils varies greatly in different states. The soils of Florida are generally well supplied with calcium and phosphorus, but deficient in potassium, while in Illinois phosphorus is said to be the element most in danger of exhaustion. The average composition of fertilizers used varies from state to state, corresponding more or less with the soils (a larger proportion of potassium is used in Florida than in any other state), but no statistics of fertilizer ingredients are given in census reports; so that matter will not be taken up at the present time.

ROLAND M. HARPER

SPECIAL ARTICLES

STANDARD DAIRY SCORE CARDS

MR. JAMES D. DREW[1] presents data which should be of very general interest. The purpose of this note is to direct attention to these studies in the hope that they may receive the wide attention which they deserve. The most important result of such consideration would be the carrying out of even more comprehensive and exact studies of the same kind.

The problems taken up are essentially two:

a. What is the correlation between the grades assigned a series of dairies by the same inspectors when different score cards are used?

b. What is the correlation between the score assigned a dairy by an inspector and the quality of the milk which it places upon the market?

The first of these problems is of technical importance in determining the degree of reliability of the application of score cards to the grading of dairies. The second is fundamental to the determination of the utility of the score card in the grading of milk, and thus one of first rate practical significance to the consumer of dairy products.

For purposes of review it has seemed best to express the detailed observations in the succinct terms of statistical constants. The personal opinion of the reviewer that such statistical constants are better as a means of expressing the results than the mere comparison of individual points of detail, and his conviction that the analysis of the data in certain of its more refined essentials can be carried out only by such formulæ, must not be taken as a criticism of the data or their discussion in the paper under review.

With regard to the agreement between the three methods of grading, the authors confine their discussion to the relative positions of the individual dairies on the three score cards. The correlation coefficients[2] are illuminating. They are:

[1] Drew, J. D., "Milk Quality as Determined by Present Dairy Score Cards," *Bull. N. Y. Agr. Exp. Sta.*, 398, Geneva, March, 1915. The work was originally planned by Dr. H. A. Harding, and is now being carried out in cooperation with the Illinois Agricultural Experiment Station.

[2] Data for 34 barns are given. For 23 of these bacterial counts for morning milk as well as evening milk are available. As a precaution against arithmetical slips I have marked out the correlations between the results by the three cards for both the total series and the sub-series for which morning milk was available. The latter should be essentially a random sample of the former.

Card Used	$N = 34$	$N = 23$
New York City and Official score	$.770 \pm .047$	$.713 \pm .069$
New York City and Cornell score	$.719 \pm .056$	$.803 \pm .050$
Official score and Cornell score	$.831 \pm .036$	$.769 \pm .057$

These results for total score by the three different cards are high, but they fall far short of the $r = 1$ which indicates perfect correlation, and which should be obtained if (*a*) the score cards were perfect descriptions of the barns as places for milk production, and if (*b*) the inspectors had perfect judgment in the filling out of the cards. It is interesting to note that the grades assigned by the three methods agree equally closely (within the limits of the probable errors of sampling) whatever cards are used: New York City and Official, New York City and Cornell, and Official and Cornell gradings have sensibly the same correlation.

In the case of the New York City and the Official score, methods are graded separately. The correlations are

For 34 barns, $r = .480 \pm .089$
For 23 barns, $r = .412 \pm .117$

Thus the correlation for methods are but slightly over half the size of those for total score. This suggests that the 40 points awarded for equipment in both the New York City and the United States Department of Agriculture ("Official") cards is the great factor in bringing about a close agreement in the results (total score) obtained by the two methods. Correlating points assigned for equipment only (total score *minus* score for methods) I find

For 34 barns, $r = .733 \pm .054$
For 23 barns, $r = .685 \pm .075$

The lower correlation of the values assigned for methods as compared with those for equipment is perhaps the most serious criticism to be made of the score cards.

While the agreement between the scores assigned by different cards falls far short of perfect correlation, it is interesting to note that *the agreement is actually closer than that for bacterial count in evening and morning milk from the same dairies.* Here the correlation is only

$$r = .456 \pm .111.$$

The relationships between the scores assigned by the various cards and the bacterial counts are naturally the results of the greatest interest. All the possible correlations have been worked out and are presented in the accompanying table.

CORRELATION OF BACTERIAL COUNT WITH SCORE-CARD ENTRIES

Card Used	Evening Milk, 34 Barns	Morning Milk, 23 Barns
New York City		
Total score ...	$-.077 \pm .115$	$-.046 \pm .140$
Methods only..	$+.024 \pm .116$	$-.061 \pm .140$
Equipment only	$-.170 \pm .113$	$-.022 \pm .141$
Official		
Total score ...	$-.003 \pm .116$	$-.196 \pm .135$
Methods only.	$-.140 \pm .113$	$-.310 \pm .127$
Equipment only	$+.065 \pm .116$	$-.039 \pm .141$
Cornell	$-.013 \pm .116$	$-.102 \pm .139$

Twelve out of 14 of these correlations are negative in sign. All six of those for total score are negative. In other words, as the ratings assigned by the inspectors became higher the bacteria became fewer. This is of course as one would like it to be. Practically, however, the author's statement, that there is apparently no correlation between the bacterial count and score as expressed by any one of the cards, fully expresses the facts. The constants are almost without exception very small indeed. There is not a single one which can be safely considered as significant in comparison with its probable error!

Such are the results:

a. The correlation between the total scores assigned the same barns by the same inspector using the three most important cards is only about three quarters of its theoretical maximum value. The correlation between the scores for methods only is less than half its theoretical value.

b. There is practically no correlation at all between the scores assigned the barns by dairy inspectors and the bacterial content of the milk which they place upon the market.

c. When correlations so low as those deduced from the present figures are found between the bacterial counts of morning and evening

samples of milk from the same barns, it is clear that much remains to be done in the perfection of the technique of sampling and bacteriological analyses of milk.

These data show how flimsy is the basis for the common belief that there is a relation between the score of a dairy and the quality of the milk produced by it, and how premature the official sanction for the grading of milk by means of dairy scores.

J. ARTHUR HARRIS

"SOIL ACIDITY AND METHODS FOR ITS DETECTION"[1]

IN a previous issue of SCIENCE, J. E. Harris[2] published an article entitled similarly as above. In this article Harris states that two theories have been advanced to explain soil acidity, viz., the humic-acid theory and the colloid absorption theory. This same investigator also makes reference to an article published by the present writer on a new method for the determination of soil acidity,[3] and after quoting the writer in regard to the use of calcium chloride in this method, says:

> This statement brings out very clearly the absurdity of the position of those who accept the humic acid theory. These humic acids are supposed to be strong enough and soluble enough to liberate hydrochloric acid from calcium chloride, but not strong enough or soluble enough to liberate hydrogen sulphide from zinc sulphide. It is also suggested that this method be made the basis for a quantitative determination of the lime requirements of the soil. The writer does not believe this is possible because he has shown[4] that acid soils do not absorb equivalent amounts of different ions.

Although Harris apparently assumes that the writer believes soil acidity in upland soils is due largely to the so-called humic acids, yet the writer has never published such views or believed that such was the case. The writer also wishes to state that he is even more adverse to accepting the colloid absorption theory as an explanation of soil acidity, than he is to accepting the so-called humic acid theory. The acidity of peat and muck soils is undoubtedly due in part to organic acids. There are upland soils, however, which are practically free of organic matter and still they react strongly acid. Similar soils containing considerable organic matter appear to retain all their acid properties even after the organic matter is destroyed with hydrogen peroxide. What is this inorganic acidity due to? Harris and many other investigators have assumed that it is due to absorption of bases by soil colloids. They have arrived at this conclusion because by their methods of experimentation, acid soils do not take up chemically equivalent amounts of the different bases. Colloids exhibit similar properties as to the absorption of bases, and hence they conclude that soil acidity is due to colloids. Let us carefully examine the facts and draw our conclusions accordingly:

Upland soils consist of from 75 per cent. to over 95 per cent. of silicates and silica. Silicates are salts of various silicic and alumino-silicic acids. The water solution in the soil slowly reacts with these silicates, forming with the bases of the silicate a soluble hydroxide or salt, which is taken up by plants or removed in the drainage water. The other product, an acid silicate, being comparatively insoluble, accumulates in the soil and gives rise to an acid condition. The writer and assistants have treated powdered basalt, granite, feldspar and other minerals with carbonated water, and after filtering have obtained residues which are acid to litmus and other tests. This is essentially comparable to the weathering process going on in soils. Acid soils treated in this way are made more acid.

If soil acidity is due to true acids and acid salts such as acid silicates, why have investigators not been able to show that acid soils take up equivalent amounts of the different bases from salt solutions? This is due to the fact that the acid silicates and their neutralized products are only very slightly soluble, and the solubility of the neutralized silicates varies according to the base that effects the neutralization. The law on which the ad-

[1] Published with the permission of the director of the Wis. Expt. Station.

[2] SCIENCE, 40 (1914), 49.

[3] SCIENCE, 40 (1914), 246.

[4] *Jour. Phy. Chem.*, 18 (1914), 355.

herents of the colloid theory base their conclusion reads as follows: The relative affinity of the acids is independent of the nature of the base. *It must be carefully noted that this law only holds when all the reacting substances are in a true solution, or if there are partially soluble substances formed, then in any series of comparisons, the solubility of the corresponding substances must be of the same order. The opportunity for secondary or side reactions must also be eliminated or made comparable. In the soil there is almost unlimited opportunity for these side reactions to occur. Most previous investigators of soil acidity and absorption have entirely overlooked and ignored these most important considerations and hence have accordingly arrived at erroneous conclusions.*

In order to overcome these difficulties and make the conditions more comparable, the writer has proceeded as follows: Small amounts of very finely powdered soil were thoroughly shaken with comparatively large amounts of the respective salt solutions for a short period and then quickly filtered, and the acidity of the filtrate determined. *When this was done the soil took up very nearly equivalent amounts of different bases from salts having a common acid ion.* The use of very finely powdered soil and the procedure of thoroughly shaking made the conditions more like those of a true solution than was the case of other investigators. The use of an overwhelming mass of salt solution in comparison to the soil used equalizes the side reactions to a large extent. The main reaction takes place almost instantly, and hence the treatment should be short in order to prevent further side reactions. The results of these experiments point strongly to the existence of true acid substances as the cause of soil acidity.

Besides this active acidity, there is in soils usually a considerable amount of inactive acidity, which comes into play on continued treatment with salt solutions or basic materials. The writer has evidence, though not conclusive, which indicates that kaolin is a substance which may exist as either an active or an inactive acid. It is possible that rearrangements of the molecule, or polymerization may be the cause of this. In contact with basic material, kaolin gradually takes up more and more base, which may be due to the gradual change of kaolin to the active acidic form. Treatment with carbon dioxide or other acids also seems to cause a change to the active form.

The writer and assistants have perfected a new quantitative method for soil acidity. In this method 25 g. of soil are moistened in a casserole with 35 c.c. of water and then treated with an excess of barium hydroxide solution. This is allowed to act for *one minute* with constant stirring and then carbon dioxide is immediately passed in, changing the excess of hydroxide to the carbonate. The material is evaporated to complete dryness on a steam bath, and then the excess of hydroxide is measured by determining the carbonates present. A special form of apparatus has been devised for making this carbonate determination. It can also be used for determining carbonates in non-acid soils. When the determination is made by this method, it makes little difference whether calcium, barium or sodium hydroxide is used to neutralize the acidity. If soil acidity is due to colloids, then according to the properties of colloids it should take different chemical equivalent amounts of sodium, barium and calcium hydroxide. This, again, indicates very strongly that soil acidity is due to true acids and not colloids. The writer has a considerable amount of other data which bears on the subject at various angles, but always supports the existence of true acids as the cause of soil acidity.

There is no question but what colloids exist in soils. Some colloids absorb bases and others absorb the acid ion. The amount of absorption, however, in the case of the pure colloids which have been worked with in the laboratory is very small in comparison to the phenomena going on in acid soils. The absorption capacity of these colloids is practically negligible as far as soil acidity is concerned. The wrongly so-called selective absorption of bases in soils has received a large amount of attention during the past fifty years, but the ex-

planations of the phenomena have never been satisfactory. It is for the most part not an absorption phenomenon but a true chemical reaction consisting of an exchange of bases between a soluble salt and silicate, or else a neutralization of acid substances by the base of a salt giving rise to a soluble acid, as in the case in acid soils. In the case of peats and soils high in organic matter, organic compounds may cause similar phenomena. The writer has been unable to obtain or find any data which on careful consideration would lend support to the colloid absorption theory of soil acidity.

The new test for soil acidity which the writer had previously described[5] has now been tried on a very large number of soils and found entirely satisfactory. As is obvious, it is absolutely necessary to use *neutral* calcium chloride and zinc sulphide in the test. Merck's reagents have given perfect satisfaction. In reply to Harris,[6] the writer wishes to state that acid soils react without the use of calcium chloride and hence his comment does not apply.

Although soils are composed for the most part of silica and silicates, yet the function of the silicates in soil fertility has been almost entirely ignored. Their function in the inorganic world is analogous to that of the proteins and carbohydrates in the organic world. The complex nature and behavior of the silicates makes possible the great regulatory processes going on in soils. The property of certain silicates by means of which they change from an active acidic state, a condition in which they actively take up bases from solution, to a condition of inactivity, and also the change in the reverse direction, is of the greatest importance. This property makes possible the presence of an enormous amount of such silicates which prevent undue loss by leaching without giving rise to the excessively acid condition which would otherwise be necessary. The root hairs of plants are probably among the most delicate of all external organs in either plant or animal life. In the soil there are a great variety of processes going on, resulting undoubtedly in the formation of not only beneficial substances, but also of some harmful ones. If this is the case, it is probable that nature has made some provision for inhibiting the deleterious action of the harmful substances on the delicate root hairs. It seems possible that the silicates may form temporary combinations with these substances and thus prevent unfavorable action on the root hairs. The wonderful influences, in other than physical ways, of a small amount of such silicates commonly called clay, on the fertility of sandy soils has been known for a long time, and a consideration of the above aids greatly in its explanation. The writer has in preparation a detailed paper dealing with the subject of soil acidity and related phenomena.

E. TRUOG
DEPARTMENT OF SOILS,
WISCONSIN EXPERIMENT STATION,
UNIVERSITY OF WISCONSIN

[5] *Loc. cit.*
[6] *Loc. cit.*

A NEW METHOD OF MEASURING THE CONCENTRATION OF THE SOIL SOLUTION AROUND THE SOIL PARTICLES

IN conducting a thorough investigation on the general subject of soil temperature the influence of soluble salts on the lowering of freezing point of soils was also studied. It was observed that the phenomena of supercooling and freezing behaved in moist soils exactly the same way as in solutions. These facts suggested the ideas that the freezing point method might be employed to measure the concentration of the soil solution around the soil particles. In order to ascertain whether or not this could possibly be done a series of experiments was instituted, using different classes of soil with various moisture contents, or known concentration of solutions. It has been found that the freezing point of the soil solution around the soil particles can be determined with great ease. Solidification can be started when the soil mass is supercooled to only about 0.2° C., by simply moving the thermometer in the soil. The starting of the solidification is far easier in soils than in solutions. The freezing point of soils can be determined even when the moisture con-

tent is reduced to or slightly below the wilting coefficient. In the case of quartz sand, for instance, the freezing point can be measured when the amount of water present is only about 0.8 per cent. Below the wilting coefficient the solidification is started with some difficulty, and the duplicate determinations do not agree very closely, especially if the concentration of the solution is very high. Above the wilting point the solidification does not only start with great ease, but the determinations can be duplicated with a surprising closeness; the values either agree exactly with one another or show deviations of only a few thousandths of a degree, using the Beekmann thermometer.

In determining the freezing point of different classes of soil the remarkable fact was discovered that the freezing point lowering, and consequently the concentration of the soil solution varies directly with the amount of water present. The following figures show the freezing point lowering, using distilled water as a basis of comparison, of natural soils containing high and rather low moisture content.

TABLE I

Freezing Point Lowering of Different Classes of Soil at Different Moisture Content

Soil	Freezing-point Lowering	Per Cent. Moisture
Sand	0.033° C.	6.22
Loam	0.050	33.46
Clay	0.098	24.68
Clay	0.090	38.00
Peat	0.021	181.60
Sand	0.171	2.80
Loam	0.251	25.15
Clay	0.695	18.23
Clay	2.290	12.00
Peat	0.050	138.97

It will be evident from the above table that when the soils contain a high moisture content the lowering of the freezing point, and consequently the concentration, is rather small, and does not vary greatly between the different soils. But when the moisture content of these same soils is reduced considerably, the lowering of the freezing point is increased in some cases very greatly. When it is considered that about 4,000 parts of mineral salts in 1,000,000 of water cause a depression of the freezing point of only about 0.090° C., the above figures for the soils with low moisture content represent an enormous concentration, especially in some cases.

In order to ascertain (1) the sensitiveness of the method to detect differences in concentration in the soil solution, and (2) to see whether the concentration of the soil solution can be increased by the addition of mineral salts, a complete nutrient stock solution was prepared from which solutions were made up varying in concentration from 80 to 4,000 parts per million. The freezing point of these solutions alone, and in contact with soils was determined. Some of the results thus obtained are shown in Table II.

TABLE II

Lowering of the Freezing Point of Soils with a Nutrient Solution of Different Concentration

	Lowering of the Freezing Point		
	80 P. P. M.	2,000 P. P. M.	4,000 P. P. M.
Solution	**0.005**	**0.043**	**0.083**
Sand	0.005	0.040	0.085
Loam	0.005	0.036	0.067
Clay	0.006	0.037	0.065
Peat	0.005	0.021	0.050

The values for the soils represent the depression of the freezing point caused only by the addition of the respective solutions; the depression due to the soils themselves has been deducted.

An examination of the above results reveals the interesting fact that the lowering of the freezing point of the solutions in contact with the soils does not vary very much from that of the solution alone.

There is at present no other method capable of measuring the concentration of the soil solution in the soil or around the soil particles. The foregoing method has yielded, thus far, some very remarkable results, and promises to give us a better understanding of the fundamental principles governing the soil solution.

George Bouyoucos,
M. M. McCool
Michigan Agricultural College